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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 12, NUMBER 17
SEPTEMBER 1, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 17
SEPTEMBER 1, 1979

W79-08001 -- W79-08500

Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

ELECTROLYTIC METHOD FOR MEASURING FLOW VELOCITY,
For primary bibliographic entry see Field 7B.
W79-08144

PREDICTION OF DRAINAGE DENSITY FROM SURROGATE MEASURES,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7C.
W79-08265

TERRACES IN ARID STREAM VALLEYS. A PROBABILITY MODEL,
Hebrew Univ. Jerusalem (Israel). Inst. of Earth Sciences; and Clark Univ., Worcester, MA. School of Geography.
A. P. Schick, and D. Magid.
Catena, Vol. 5, No. 3/4, p 237-250, Dec. 1978, 5 fig, 7 tab, 9 ref.

Descriptors: *Stochastic processes, *Probability, *Model studies, *Computer models, *Terraces(Geologic), Analytical techniques, Mathematical models, Floods, Streambeds, Deserts.

A stochastic model for the number of terraces in a desert stream valley has been developed which enables the generation by computation of a time series of the number of terraces which occur at a given valley cross section depending upon the efficiency of major 'super floods' in the obliteration of these terraces. The purpose of the study was to further develop the empirical probabilities of any number of terraces by working with a longer time series, establish expected theoretical probabilities, and suggest some model alterations, directions and additional uses for future studies in light of some geomorphic implications. On a theoretical basis it is shown that of the number of super floods necessary for obliteration is one, the probability of having no terrace is one third and of having one terrace is two thirds. Model procedures have been described in detail previously (Schick, 1974) and the present paper briefly summarizes this earlier work with emphasis on recent changes and amplifications. (Tickes-Arizona)
W79-08359

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. E. Hillier, P. A. Schneider, Jr., and E. C. Hutchinson.
Availability: OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Price: Paper copy, $14.25, Microfiche, $4.25. Geological Survey open-file report 79-214, January 1979. 68 p, 2 fig, 1 plate, 4 tab, 5 ref.

Descriptors: *Groundwater resources, *Aquifers, *Water wells, *Water levels, *Water quality, Springs, Well data, Water table aquifers, Colorado, *South Platte River basin, Denver area(Colo).

As part of the U.S. Geological Survey's investigations of the hydrology and geology in the Front Range Urban Corridor of Colorado, hydrologic data for water-table aquifers in the greater Denver area were collected and compiled during 1976-77. These data, consisting of records for 325 wells and 11 springs and chemical analyses of water for 272 of the wells and all 11 springs, are presented in tabular form. The tables contain data that were collected during the investigation, data compiled from reports published by the Colorado Water Conservation Board and the U.S. Geological Survey, and unpublished data from the files of the U.S. Geological Survey. State and local officials in the greater Denver area may find these data useful in planning for residential, commercial, and industrial development. (Woodard-USGS)
W79-08394

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX B--HYDROLOGY,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 747, Price codes: A11 in paper copy, A01 in microfiche. Chaired by the U.S. Geological Survey, 1969, 165 p, 36 tab, 47 fig, 21 maps, 23 photos.

Descriptors: *Hydrology, *Water resources, *Planning, *Groundwater, *Groundwater availability, *River basin development, *Willamette River(OR), Oregon, Geohydrologic units, Surface water availability, Hydrologic data, Glaciohydrology, Hydrologic aspects, Hydrologic budget, Hydrologic cycle, Climate, Water supply, Watersheds(Basins), Climatic data, Regional analysis, Data collections, Surface-groundwater relationships, Legal aspects, Water rights, Storms, Water resources development, Water quality, River basins.

The study was undertaken to plan for the proper development of water and related land resources of the Willamette Basin in Oregon. Appendix B, along with Appendices A and C, provides supporting data for the functional Appendices D through L. Climate is first discussed, including the climatic significance of geographical features such as the Pacific Ocean, the Columbia Gorge, and the Coast and Cascade Ranges, climatic elements (e.g., temperature, precipitation, evaporation), and meteorological aspects of major storms--rain, wind, and snow. A description of water resources, their distribution, and their variation at different times are presented. These resources are described in terms of factors influencing the occurrence of water. Specifically reviewed here are surface waters, groundwater, the relationship between surface and groundwater, management programs, and water rights and legal restrictions. Lastly, the adequacy of hydrologic data is reviewed. Statistical and interpretive hydrologic data necessary for broadscale water resources planning are provided. Data assembled are those concerning climate, streamflow, lakes and glaciers, chemical-quality, sediment, stream temperature, and groundwater. Geologic and soils mapping are briefly discussed, and a list of references is provided. (See also W79-08433) (Zayac-NC)
W79-08435

2B. Precipitation

LATE CENOZOIC PALAEOENVIRONMENTS ON THE WEST COAST OF SOUTH AFRICA,
South African Museum, Cape Town.
A. J. Tankard, and J. Rogers.
Journal of Biogeography, Vol. 5, No. 4, p 319-337, December 1978. 5 fig, 3 tab, 80 ref.

Descriptors: *Coasts, *Paleoclimatology, *Quaternary period, *Climatic change, *Atmospheric physics, History, Meteorology, Paleohydrology, Miocene epoch, Cenozoic era, Tertiary period, Climatology, Air circulation, Synoptic analysis, South Africa, Coastal deserts, Anticyclones, Weather patterns.

Widespread aridity on the western coast of South Africa is related to upwelling of cold subsurface waters. Physical, chemical, and biological attributes of Tertiary and Quaternary strata suggest that this aridity has developed progressively since the Miocene. The present study of this littoral, describing the development of desiccation through the late Cenezoic, points out the relative youthfulness of the Namib Desert and shows evidence of late Pleistocene climatic changes. Age correlations relate these paleoclimatic events to the history of the Southern Ocean and Antarctic Ice Cap, indicating that aridity was initiated in the late Tertiary but only fully established in the Quaternary. Climatic belts expanded poleward during the late Pleistocene hyperthermal, and greater aridity in the Southwestern Cape at that time is attributed to the increased influences of trade winds and the poleward shift of westerlies. Conversely during the succeeding hypothermal a 5 degree equatorward shift of anticyclone tracks and climatic belts enabled westerly winter rainfall to reach latitude 23 degrees S. During this time ephemeral rivers on the Namaqualand Coast were rejuvenated, palaeolakes filled during the later half of the last major sea level regression, and the arid zone moved equatorward. Atmospheric circulation and probably aridity are speculated to have been more intense at this time in the arid core of the north than they are today. (Tickes-Arizona)
W79-08023

ANALYSIS OF ANNUAL RAINFALL OF RAJASTHAN DESERT,
Udaipur Univ. (India). Soil and Water Conservation Engineering.
J. F. Correia.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 158-165, Dec 1977. 4 tab, 5 fig, 7 ref.

Descriptors: *Rainfall disposition, *Statistical methods, *Frequency analysis, *Forecasting, *Climatic data, *Time series analysis, Regression analysis, Rajasthan Desert, India, Droughts, Water shortage.

The 78 year rainfall record (1891-1968) of the 11 western districts in the arid region of Rajasthan is analysed here, the 10-year progressive mean is plotted, and an equation derived for the prediction of annual rainfall in the area. Mean annual rainfall of the region, averaged arithmetically for 78 years, was 367.9 mm with the ratio of maximum to minimum varying from 5.8 to 94.0 depending upon district. A close examination of the 10-year progressive mean indicates that it follows a typical decay curve in which the 10-year moving average curve represents a series of progressive harmonic waves with varying successive periods of 15, 13, 5, 6, 6, 12, and 12 years. The lognormal distribution is found to be in close agreement with the observed data and is used here to predict average annual rainfall probabilities and recurrence intervals with reasonable confidence. Rainfall in this arid region is erratic and unpredictable, with only 10% of the years being normal, and nearly 1 out of 2-1/2 years receiving highly deficient rainfall. (Tickes-Arizona)
W79-08026

SIX-MINUTE RAINFALL INTENSITY DATA FOR AN EXCEPTIONALLY HEAVY TROPICAL RAINSTORM,
Queensland Dept. of Forestry, Atherton (Australia).
D. A. Gilmour, and M. Bonell.
Weather, Vol. 34, No. 4, p 148-158, April 1979. 5 fig, 4 tab, 7 ref.

Descriptors: *Rainfall intensity, *Demonstration watersheds, *Australia, *On-site investigations, Small watersheds, Rainfall, Tropical regions, Measurement, On-site data collections, Synoptic analysis, Storms, Foreign research, Temporal distribution, *Babinda(Australia), *Queensland(Australia).

The object was to give details of 6-minute rainfall intensities for an exceptionally heavy storm event which took place in a 25 ha catchment of tropical rainforest in north-east Queensland, Australia. The experimental area is located 5 km east of Babinda (17 deg 20 min S) adjacent to the Coral Sea and in the midst of the wet tropical coastal belt of north-east Queensland. The catchment has recorded a mean annual rainfall of 4239 mm for the 8-year period 1970 to 1977. The weekly maximum 6-minute intensities were evaluated for the 1976 'wet season' for the purposes of statistically relating precipitation to overland flow generation in the tropical rainforest catchment. The storm under investigation occurred in December 1976 and generated the highest short-term intensities since records commenced. A detailed breakdown of 6-minute intensities was tabulated. High, short-term rainfall intensities were demonstrated for an event typical of the severe flood-producing rains which are experienced on the north tropical coast. While

it was certainly a major storm event, it was by no means extreme, as the nearby town of Babinda has recorded several daily falls in excess of 500 mm. When the length of the catchment record is sufficient, it is intended to produce a frequency-amount-duration analysis for various periods ranging from 6 min to 24 hrs. (Humphreys-ISWS)
W79-08123

ON THE EFFECT OF PRECIPITATION AND RUNOFF ON COASTAL CIRCULATION IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2L.
W79-08237

ANALYSIS OF RANDOMIZED WINTER OROGRAPHIC CLOUD SEEDING EXPERIMENTS IN UTAH,
Utah Water Research Lab., Logan.
G. E. Hill.
Journal of Applied Meteorology, Vol. 18, No. 4, p 413-448, April 1979. 26 fig, 11 tab, 10 ref. 14-06-D-6820.

Descriptors: *Cloud seeding, *Weather modification, *Utah, *On-site investigations, Precipitation(Atmospheric), Mountains, Networks, Aircraft, Rain gages, Measurement, Temperature, Air temperature, Cloud physics, Meteorology, *Wasatch Mountains(UT).

Analysis was made of two randomized winter orographic cloud seeding experiments conducted in the northern Wasatch Mountains. In the first experiment, seeding material was released from airborne pyrotechnics, and in the second experiment, from three mountain-top generators. Precipitation was measured by a network of remotely interrogated precipitation gages. Interpretation of the results was aided in particular by the use of storm type classifications, precipitation estimators based on upper level data, vertical incidence radar, and aircraft icing reports. An a priori hypothesis, that seeding of clouds would increase precipitation when the 500 mb temperature is warmer than -22 C, was rejected. Also, precipitation increases were not found in orographic clouds when the cloud-top temperature is warmer than -29 C. An a posteriori analysis than-24 C. On the other hand, stratification of experimental events according to degree of aircraft icing, as a measure of supercooled water concentration, indicated that marked seeding effects might be present. (Sims-ISWS)
W79-08244

A REANALYSIS OF THE WOLF CREEK PASS CLOUD SEEDING EXPERIMENT,
Washington Univ., Seattle. Cloud Physics Group.
A. L. Rangno.
Journal of Applied Meteorology, Vol. 18, No. 5, p 579-605, May 1979. 21 fig, 6 tab, 23 ref.

Descriptors: *Cloud seeding, *Weather modification, *Rocky Mountain Region, *Colorado, *Utah, *Arizona, *New Mexico, Precipitation(Atmospheric), Rainfall, Snowfall, Water resources, Data processing, Analytical techniques, Climatology, Cloud physics, Meteorology, *San Juan Mountains(CO), *Wolf Creek Pass(CO).

A 6-season, randomized-by-season cloud seeding experiment consisting of 3 seeded seasons and 3 non-seeded seasons was conducted by Colorado State University during the middle and late 1960's in the Wolf Creek Pass region of the San Juan Mountains of southwest Colorado. The results of the seeding have been reported in a series of papers as having produced statistically significant increases in precipitation at Wolf Creek Summit when the 500 mb temperature was warmer than 23C. Furthermore, it has been reported that increases in precipitation produced statistically significant increases in the runoffs from 3 target watersheds when compared to the runoffs from 3 control watersheds. In this paper, the results of the Wolf Creek Pass Experiment (WCPE) were reexamined. It was shown that the 3 non-seeded seasons occurred during meteorological conditions which brought 'warm aloft' (500 mb temperatures warmer than -23C) storm days with unusually light precipitation over a wide region of Colorado, northern New Mexico, southern Utah, and northern Arizona. This bias produced high values of seed/no-seed precipitation ratios at Wolf Creek Summit which led to the misperception of large increases in precipitation due to cloud seeding. It was also shown that nearly all central and southwest Colorado watersheds with similar exposures to the target watersheds for the WCPE had high runoffs during the 3 seeded seasons compared to the 3 control watersheds chosen. Hence, the increases in runoff reported from the 3 target watersheds were part of a large-scale pattern due to natural causes rather than to cloud seeding. (Sims-ISWS)
W79-08246

AN AREAL AND TEMPORAL ANALYSIS OF PRECIPITATION IN THE NORTHEASTERN UNITED STATES,
Rutgers--The State Univ., Brunswick, NJ. Dept. of Meteorology and Physical Oceanography.
C. M. Scott, and M. D. Shulman.
Journal of Applied Meteorology, Vol. 18, No. 5, p 627-633, May 1979. 8 fig, 1 tab, 11 ref.

Descriptors: *Precipitation(Atmospheric), *Northeast U.S., *Maryland, *Massachusetts, *Climatology, Data processing, Anaytical techniques, Statistics, Methodology, Spatial distribution, Temporal distribution, Mapping, Climatic data, Rainfall, Monthly, Snowfall, Meteorology, *Harmonic analysis.

Harmonic analysis, an objective method of analyzing precipitation seasonality, was applied to 1941-70 monthly precipitation normals for nearly 200 stations in the northeastern United States. This analysis presented distribution of the annual precipitation as the sum of 6 different sine curves (harmonics). The first 3 harmonics account for most of the variance in the original precipitation distribution in this area. Maps were presented of percent variance reduction and phase angle, and possible meteorological factors responsible for the observed patterns were suggested. In addition, the results were compared to previous applications of harmonic analysis to monthly precipitation normals during 1921-50 and 1931-60. The greatest difference appeared as a substantial increase in the third harmonic in the coastal region from Maryland to Massachusetts. Variance reductions as high as 73% occurred in the center of this area, compared to a maximum value of only 46% for the 1931-60 normal period. Several possible reasons for this phenomenon were discussed. (Sims-ISWS)
W79-08247

PATH-AVERAGED MEASUREMENTS OF RAIN RATE AND RAINDROP SIZE DISTRIBUTION USING A FAST-RESPONSE OPTICAL SENSOR,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
T-I. Wang, K. B. Earnshaw, and R. S. Lawrence.
Journal of Applied Meteorology, Vol. 18, No. 5, p 654-660, May 1979. 13 fig, 17 ref.

Descriptors: *Rainfall, *Raindrops, *Instrumentation, Measurement, Particle size, Rainfall intensity, Precipitation intensity, Precipitation(Atmospheric), Optical properties, Equipment, Electronic equipment, Engineering, Electrical engineering, Meteorology, Drop-size distributions.

Path-averaged terminal velocity distribution of raindrops was determined from the temporal covariance function of signals from two vertically spaced linear optical detectors that respond to raindrop-induced amplitude scintillations of a projected laser beam. The known monotonic relationship between drop size and terminal velocity permits the measured velocity distribution to be converted to path-averaged drop-size distribution and, in turn, to rain rate. The large capture area of the measurements over a 200 m path allows drop-size distribution to be measured in short time intervals. This paper presented measurements of path-averaged rain rate and raindrop size distribution made at 42 s intervals. The terminal velocity distribution during a storm that contained a mixture of rain and hail clearly showed the two-component nature of the precipitation. (Sims-ISWS)
W79-08249

RAINFALL ALONG THE EAST COAST OF SOUTHERN AFRICA, THE SOUTHERN OSCILLATION, AND THE LATITUDE OF THE SUBTROPICAL HIGH PRESSURE BELT,
University of the Witwatersrand, Johannesburg (South Africa).
T. G. J. Dyer.
Quarterly Journal of the Royal Meteorologial Society, Vol. 105, No. 444, p 445-451, April 1979. 1 fig, 6 tab, 5 ref.

Descriptors: *Rainfall, *Africa, *Australia, *Analytical techniques, Regression analysis, Correlation analysis, Pressure, Atmospheric pressure, Coasts, Weather, Forecasting, Precipitation(Atmospheric), Meteorology, Pressure belts, Southern oscillation.

Eighteen rainfall series within a latitude belt 28 deg 08 min S to 30 deg 25 min S were inspected for relationships with Pittock's L index for the latitude of the subtropical high pressure belt (eastern Australia) and the southern oscillation index. Principal components analysis was used to reduce the dimensions of each of the 3 data sets, and the components for the pressure systems were used as independent variables in a step-wise regression analysis. Rainfall components were taken as the dependent variables. Useful relationships exist between rainfall and Pittock's L, but there is no evidence to suggest that the same situation applies for the southern oscillation index. The results agreed with those recently obtained for Mauritius by M. D. Dennett. (Sims-ISWS)
W79-08268

THE PREDICTED ABOVE-NORMAL RAINFALL OF THE SEVENTIES AND THE LIKELIHOOD OF DROUGHTS IN THE EIGHTIES IN SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa).
P. D. Tyson, and T. G. J. Dyer.
South African Journal of Science, Vol. 74, No. 10, p 372-377, Oct 1978, 5 fig, 3 tab, 23 ref.

Descriptors: *Rainfall disposition, *Depth-area-duration analysis, *Distribution patterns, *Forecasting, Meteorology, Climatic change, Droughts, Data collection, South Africa.

Summer rainfall patterns for northern and eastern South Africa are examined here and estimates of changes based upon the analysis of data for 1910-67 suggesting that during the seventies the region as a whole would experience an extended wet spell are compared with actual changes that occurred in the 1968-1972 period. Results have indicated that while it is not possible to predict actual year-to-year rainfall for particular places of regions as a whole, the prediction of an extended spell of above average rainfall can be made. Additional revised estimates of the likelihood of future wet and dry spells based upon data from 191 stations for the 1910-1977 period are presented and indicate that during dry spells rainfall over most of South Africa was from 80-90% of the mean while during wet spells it varied from 110% to 120% of the mean with the exception of the present spell of the seventies when, for the five years of the spell to date, up to 200% of the mean has been experienced over the Cape interior. (Tickes-Arizona)
W79-08367

2C. Snow, Ice, and Frost

SNOW ACCUMULATION, DISTRIBUTION, MELT, AND RUNOFF,
Army Terrestrial Sciences Center, Hanover, NH
S. C. Colbeck, E. A. Anderson, V. C. Bissell, A. G. Crook, and D. H. Male.
EOS, Transactions, American Geophysical Union, Vol. 60, No. 21, p 465-468, May 22, 1978 3 fig, 29 ref.

Descriptors: *Snow, *Snow surveys, *Reviews, Snow cover, Spatial distribution, Snowmelt, Runoff, Movement, Data processing, Water equivalent, Instrumentation, Hydrology, Remote sensing, Model studies, Physical properties, Cold regions, Snowpacks, Flow, Ablation, Albedo, *Research needs.

The authors outlined their ideas about the current status and needs in snow hydrology in order to provide some guidance for the multitude of national and local organizations that are affected by these problems. Subjects discussed included collection and processing of snow survey data, energy exchange at the snow surface, water movement and snow properties, snow accumulation and ablation models, Arctic and subarctic hydrology, and remote sensing. A detailed understanding of the properties and processes of snow is crucial to the development of adequate models of the snow cover to meet the requirements of today's society. However, it is clear that these models can only represent the snow cover through knowledge generated by the appropriate research. It is also clear that the usefulness of these models is greatly limited by the ability to provide the quality and quantity of necessary input data. While major advances are being made in this respect by remote sensing, a large number of 'weak links' have been identified in the system. A particular 'weak link' depends upon the problem being studied, the accuracy desired, the geographical area, and prevailing conditions at that moment. The polar and subpolar regions are special in this regard because of the lack of background data, the harsh environment, and the inaccessibility of many sites. (Humphreys-ISWS)
W79-08078

DRIFTING SNOW SIMILITUDE,
Iowa State Univ., Ames. Dept. of Aerospace Engineering.
J. D. Iversen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14647, p 737-753, June 1979. 5 fig, 2 tab, 31 ref, 1 append.

Descriptors: *Snow, *Snowpacks, *Model studies, Mathematical models, Laboratory tests, Winds, Sediments, Sediment transport, Physical properties, Dimensional analysis, Saltation, Simulation analysis, Analytical techniques, Wind tunnel tests, Snowdrifts.

The problem of modeling the drifting of snow in a boundary layer wind tunnel was reviewed. The important dimensionless parameters that govern the drifting phenomena were introduced. Theoretical means such as the equations for mass transport rate of saltating material and the particle trajectory equations of motion were used to combine these dimensionless parameters into 5 similitude parameters. These final 5 parameters were analyzed as to their relative importance in the wind tunnel simulation of drifting snow. The properties of snow and of possible modeling materials were examined, and the final results of a previous study involving simulation of sand movement were presented. Use of a variety of model particles and the variation of vertical distortion of the modeled topography can aid in application of the results to full-scale conditions. Quantitative scaling can be achieved by measurement of the rate of accumulation of drifting material. (Sims-ISWS)
W79-08111

ON THE STATISTICAL DISTRIBUTION OF PRESSURE RIDGES IN SEA ICE,
Intera Environmental Consultants Ltd. Ottawa (Ontario).
R. T. Lowry, and P. Wadhams.
Journal of Geophysical Research, Vol. 84, No. C5, p 2487-2494, May 20, 1979. 7 fig, 16 ref. ONR NO 0014-76-C0660, NR307-382.

Descriptors: *Sea ice, *Statistics, *Distribution patterns, Spatial distribution, Data processing, On-site data collections, On-site investigations, Mathematical models, Model studies, Analytical techniques, *Pressure ridges, Ridge spacings, Ridge heights.

Probability distributions for the heights and spacings of sea ice pressure ridges were described and compared with data from airborne laser profiles and submarine sonar profiles. The distributions were based on the variational calculations of Hibler but take into account the effects of finite slope angles of ridges and of the criterion used to identify an independent ridge during computer reduction of data. The modified distributions were shown to give a much better fit for small ridge spacings and slightly better fit for small ridge heights than the 1972 theory. (Sims-ISWS)
W79-08112

DETERMINATION OF THE WATER CONTENT OF SNOW FROM THE STUDY OF ELECTROMAGNETIC WAVE PROPAGATION IN THE SNOW COVER,
Ecole Nationale Superieure d'Electronique et de Radioelectronique et de Radioelectricite de Grenoble (France). Lab. d'Electromagnetisme.
J. Tobarias, P. Saguet, and J. Chilo.
Journal of Glaciology, Vol. 20, No. 84, p 585-592, 1978. 9 fig, 4 ref.

Descriptors: *Moisture content, *Snow, *Mathematical models, *Electromagnetic waves, Snow cover, Measurement, Model studies, Methodology, Analytical techniques, Theoretical analysis, Laboratory tests, Equations.

A method was proposed for measuring in situ and continuously the water content of a sample of snow in the snow cover. This method is based on the measurement of the attenuation of an electromagnetic wave propagating in a sample of snow situated between two antennae, an emitter, and a receiver. The working frequency is 9.4 GHz. (Humphreys-ISWS)
W79-08113

AN INEXPENSIVE TENSIOMETER FOR SNOW-MELT RESEARCH,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
A. Wankiewicz, and J. De Vries.
Journal of Glaciology, Vol. 20, No. 84, p 577-584, 1978. 6 fig, 5 ref.

Descriptors: *Snowmelt, *Tensiometers, *On-site tests, *Instrumentation, Hydrology, Snowpacks, Melt water, Flow, Pore pressure, Water pressure, Measurement, Monitoring.

The construction and use of a rugged and easily installed tensiometer for use in snow hydrology were discussed. The tensiometer incorporates a short (380 mm) water manometer, adequate for the small range of capillary pressure in melting snow. The response of a row of tensiometers to the application of a dyed water pulse to the snow surface was compared to the resulting dye stain pattern. The use of a tensiometer in a snow-pack requires special attention to the following 4 points: (1) the tensiometer must be used only in a wet snow-pack, and care must be taken to prevent freezing of the exposed manometer; (2) the height of the porous cup relative to the manometer scale zero (the zero offset) should be accurately known, a task made more difficult by melting of the snow surface and snow-pit walls; (3) the lateral variation in flow requires the use of many tensiometers if the mean snow-water pressure of a layer is required; and (4) short-wave radiation penetrating the snow from the access snow-pit must be minimized to produce an insignificant change in snow properties in the vicinity of the porous cup. (Humphreys-ISWS)
W79-08114

DISRUPTION OF BEDROCK BY THE GROWTH AND COLLAPSE OF ICE LENSES,
Aberdeen Univ. (Scotland). Dept. of Geography.
G. Thom.
Journal of Glaciology, Vol. 20, No. 84, p 571-575, 1978. 4 fig, 2 tab, 3 ref.

Descriptors: *Ice, *Geomorphology, *Antarctic, *On-site investigations, Explorations, Topography, Shape, Potholes, Petrology, On-site data collections, Collapse, Ice lens, Hummocks.

Hummocks and hollows were found developed in bedrock in the South Shetland Islands, Antarctica. Excavation revealed an ice lens 60 cm thick beneath a hummock. A cycle for the formation of the hummocks and hollows by the growth and collapse of ice lenses was suggested as follows: (1) An ice lens is initiated at a point in the bedrock and begins to grow, heaving up the bedrock which cracks vertically to accommodate the expansion and deformation. (2) As the ice lens grows, the sides of the hummock steepen, enhancing mass wasting and resulting in the removal of material from the hummock. (3) During the winters, the lens increases in size until a threshold is reached when the widening of the crack alters the thermal conductivity of the system to such an extent that the lens is susceptible to melting in subsequent summers. (4) With the melting of the lens, the bedrock collapses and, because of the removal of material from the system, a hollow is produced. (Humphreys-ISWS)
W79-08115

FABRICS OF ICING-MOUND AND PINGO ICE IN PERMAFROST,
Hardy (R. M.) and Associates, Calgary (Alberta).
W. A. Gell.
Journal of Glaciology, Vol. 20, No. 84, p 563-569, 1978. 3 fig, 23 ref.

Descriptors: *Ice, *Permafrost, *Canada, *On-site investigations, Crystal growth, Exploration, Crystallography, Crystals, Size, Shape, Sampling, Laboratory tests, Frozen soils, Pingo ice, Crystal characteristics, Icing mounds.

Crystallization histories of some ice layers in permafrost were inferred from crystal size, shape, dimensional and lattice orientation, and inclusion patterns. In an icing mound, formed by injection of water beneath frozen active-layer soil, early growth was rapid, indicated by copious small crystals and bubbles, followed by slower growth giving rise to crystals and bubbles elongate parallel to the freezing direction. C-axes were normal to crystal long axes. In a small pingo, bulk water existed temporarily at the freezing interface and freezing was unidirectional. In a larger pingo, variations in freezing rate were inferred. Later flow of ice modifies growth fabrics. (Humphreys-ISWS)
W79-08116

ICE-WEDGE ICE, MACKENZIE DELTA-TUKTOYAKTUK PENINSULA AREA, N.W.T., CANADA,
Hardy (R. M.) and Associates, Calgary (Alberta).
W. A. Gell.
Journal of Glaciology, Vol. 20, No. 84, p 555-562, 1978. 5 fig, 14 ref.

Descriptors: *Ice, *Crystal growth, *Canada, *On-site investigations, Exploration, Crystals, Laboratory tests, Crystallography, Fabrics, Size, Shape, Petrography, Sampling, Ice wedges, Crystal characteristics.

Petrologic analysis was performed on ice-wedge ice in order to investigate changes in fabric across wedges in relation to the growth mechanism. Crystal size increased from the center outward, and strongly preferred dimensional orientations developed parallel to the sides of wedges. C-axis orientations changed from a horizontal girdle at wedge center to a point maximum normal to the folitation at the boundary. These changes are related to recrystallization and grain growth associated with the horizontal stress field. In massive ice penetrated by an ice wedge, crystal size and complexity of crystal shape decreased toward the wedge, dimensional orientations tended to become parallel to the wedge, and C-axes formed a point maximum normal to the wedge boundary. (Humphreys-ISWS)
W79-08117

FABRIC AND ORIGIN OF LATERAL MORAINES, BETHARTOLI GLACIER, GARHWAL HIMALAYA, INDIA,
Calgary Univ. (Alberta). Dept. of Geology.
G. D. Osborn.

Journal of Glaciology, Vol. 20, No. 84, p 547-553, 1978. 7 fig, 4 ref.

Descriptors: *Glacial drift, *Glaciology, *Exploration, *Geomorphology, Till, Glacial soils, Fabrics, On-site investigations, Foreign countries, *India, *Bethartoli Glacier, Till fabrics, Moraine fabric.

Unusually strong till fabrics in lateral moraines of Bethartoli Glacier provide information on the genesis and growth of the moraines. On the west side of the valley, downstream of the present glacier snout, several lateral moraine crests are justaposed. Because the crests generally become higher towards the valley axis, they must represent readvances of the glacier rather than recessional stages. On the east side of the valley, only a single lateral ridge is found; presumably the ridge is composed of debris from several glacial advances. On the eroded proximal flank of this ridge, a strong fabric is visible; the plane defined by a- and b-axes of stones is parallel to the distal flank of the moraine ridge, indicating that the moraine grew mainly by accretion of debris on to its distal flank. On the eroded proximal flank of the innermost west-side ridge, the equivalent fabric is weaker, suggesting that distal flank accretion was less significant and proximal flank accretion more significant than on the east side. (Humphreys-ISWS)
W79-08118

A DIRECT DETERMINATION OF AN UPPER LIMIT FOR THE ELECTRICAL CHARGE ON DISLOCATIONS IN ICE,

Illinois Univ. at Urbana-Champaign. Materials Research Lab.
D. M. Joncich, J. Holder, and A. V. Granato.
Journal of Glaciology, Vol. 20, No. 84, p 543-546, 1978. 2 fig. DMR-76-01058, DMR-77-10556.

Descriptors: *Ice, *Laboratory tests, *Electric fields, *Crystallography, Crystals, Methodology, Measurements, Zeta potential, Electrical properties, Ice dislocations, Electrical charge density.

A direct determination of the upper limit for the electric charge density along dislocations in ice was carried out by measuring the simultaneous effects of an electric field and a mechanical stress on the movement of a low-angle tilt boundary in an ice single crystal. The determination is independent of the geometry of the dislocations or the distribution of the charge along them. No measureable effects of the electric field on boundary motion were found, requiring that the charge density be less than one unit of charge for every 300 atomic lengths of dislocation. This estimate is less than large previous estimates, but it is consistent with smaller proposed values. (Humphreys-ISWS)
W79-08119

NUMERICAL MODELLING OF ICEBERG TOWING FOR WATER SUPPLIES--A CASE STUDY,

Adelaide Univ. (Australia). Dept. of Chemical Engineering.
J. G. Job.
Journal of Glaciology, Vol. 20, No. 84, p 533-542, 1978. 5 fig, 1 tab, 13 ref.

Descriptors: *Water supply, *Icebergs, *Model studies, *Transportation, *Antarctic, Melting, Mathematical models, Analytical techniques, Movement, Velocity, Energy, Ice, Analysis, Water yield, Iceberg towing, Acceleration.

The towing of unprotected icebergs from the Antarctic continent (66 deg S) to latitude 38 deg S has been simulated using an explicit hydrodynamic model and an extended two-dimensional melting model. It was found that nominal towing accelerations in excess of 0.00002 m/sec sq were required to deliver ice over this route in most circumstances, and minimum energy consumptions were obtained at accelerations around 0.0001 m/sec sq. Unprotected icebergs could be delivered with about 50% yield to latitude 38 deg S, but the rate of deterioration in the warm waters indicates that protection would be required for longer journeys. The towing simulation was most sensitive to north-south current components, the total towing distance, and the rate of iceberg deterioration. Efforts directed towards locating suitable icebergs in the region of 50 deg S to 60 deg S, and towards increasing knowledge of the changing current patterns in the Southern Ocean would be most valuable, as would a knowledge of the mechanisms and rates of deterioration of icebergs in warm seas. (Humphreys-ISWS)
W79-08120

A STUDY OF SEVERAL PRESSURE RIDGES AND ICE ISLANDS IN THE CANADIAN BEAUFORT SEA,

Gulf Oil Canada Ltd., Calgary (Alberta).
J. Hnatiuk, A. Kovacs, and M. Mellor.
Journal of Glaciology, Vol. 20, No. 84, p 519-532, 1978. 15 fig, 3 ref.

Descriptors: *Sea ice, *Exploration, *Canada, *On-site investigations, On-site tests, Methodology, Physical properties, Salinity, Density, Surveys, Water temperature, *Beaufort Sea(Canada), Pressure ridges, Ice islands.

The environmental conditions in the southern Beaufort Sea were described, with special emphasis on pressure ridges and ice islands. Techniques for determining the geometric configurations and the physical and mechanical properties of sea-ice structures and ice islands were described. Profile of pressure ridges were determined by surface surveys, drill-hole probes, and side-looking sonar scanning. Multi-year pressure ridges with thicknesses up to 20 m and widths up to 120 m were examined in detail. The first-year ridge of 22 m thickness and 100 m width was studied. Results were given for several multi-year and the first-year ridges. Information obtained from dives under the ice was also given. Corresponding data were given for grounded ice islands, with particular attention being given to contact between the ice and sea bed. A 20 m thick ice-island fragment grounded in 15 m of water was one of several investigated. Measurements of temperature, salinity, tensile strength, and compressive strength were given for ice taken from old pressure ridges, and factors influencing the interpretation of test data were discussed. The data obtained in this study will be used in engineering design studies for offshore structures for drilling and production of hydrocarbons from the Beaufort Sea area. Exploratory drilling in shallow water has already been carried out, and offshore drilling from drillships was scheduled to commence in the study area during the open water season of 1976. (Humphreys-ISWS)
W79-08121

THE EQUILIBRIUM STATE OF THE EASTERN HALF OF THE ROSS ICE SHELF,

Maine Univ. at Orono. Inst. for Quaternary Studies.
R. T. Thomas, and C. R. Bentley.
Journal of Glaciology, Vol. 20, No. 84, p 509-518, 1978. 4 fig, 1 tab, 19 ref. NSF DPP76-23047, OPP72-05802.

Descriptors: *Ice, *Antarctic, *On-site tests, *Exploration, On-site investigations, Physical properties, Velocity, Analysis, Analytical techniques, Mathematical models, Snow, Dimensions, *Ross Ice Shelf, Snow accumulation.

Measurements of ice thickness, velocity, snow accumulation rates, and surface strain-rates were used to examine the state of equilibrium of three flow bands of the Ross Ice Shelf. The analysis gave the rate of thickening of the ice shelf in terms of the basal freezing rate, which is unknown. However, indirect evidence suggests that the basal flux ranges from a small value of freezing in the south to a melting rate of about one meter of ice per year at the ice front. If these values are correct, then the flow band in the south-east corner of the ice shelf appears to be thickening at an average value of (34 + or -15) cm of ice per year. Persistent thickening at this rate must lead to grounding of large areas of the ice shelf. This would restrict drainage from West Antarctic ice streams which feed this part of the ice shelf and would tend to thicken and advance their grounding lines into the ice shelf. Further north, near the Ross Ice Shelf Project borehole site, the ice shelf is probably in equilibrium. The largest flow band is to the south and east of Roosevelt Island, and this also may be in equilibrium if there is significant bottom melting from ice shelf that is more than 100 km from the ice front. (Humphreys-ISWS)
W79-08122

BASAL SLIDING AND CONDITIONS AT THE GLACIER BED AS REVEALED BY BOREHOLE PHOTOGRAPHY,

California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
H. F. Engelhardt, W. D. Harrison, and B. Kamb.
Journal of Glaciology, Vol. 20, No. 84, p 469-508, 1978. 10 fig, 3 tab, 43 ref.

Descriptors: *Glaciers, *Washington, *On-site investigations, *Subsurface investigations, Glaciology, Borehole geophysics, Photography, Movement, Velocity, flow, Exploration, Methodology, Boreholes, Analysis, Water levels, *Blue Glacier(WA), Basal flow.

Borehole photography demonstrates that the glacier bed was reached by cable-tool drilling in five boreholes in Blue Glacier, Washington. Basal sliding velocities, measured by borehole photography, and confirmed by inclinometry, range from 0.3 to 3.0 cm/d and average 1.0 cm/d, much less than half the surface velocity of 15 cm/d. Sliding directions deviate up to 30 deg from the surface flow direction. Marked lateral and time variations in sliding velocity occur. The glacier bed consists of bedrock overlain by about a 10 cm layer of active subsole drift, which intervenes between bedrock and ice sole and is actively involved in the sliding process. It forms a mechanically and visibly distinct layer, partially to completely ice-free, beneath the zone of debris-laden ice at the base of the glacier. Internal motions in the subsole drift include rolling of clasts caught between bedrock and moving ice. The largest sliding velocities occur in places where a basal gap, of width up to a few centimeters, intervenes between ice sole and subsole drift. The gap may result from ice-bed separation due to pressurization of the bed by borehole water. Water levels in boreholes reaching the bed drop to the bottom when good hydraulic connection is established with subglacial conduits; the water pressure in the conduits is essentially atmospheric. Factors responsible for the generally low sliding velocities are high bed roughness due to subsole drift, partial support of basal shear stress by rock friction, and minimal basal cavitation because of low water pressure in subglacial conduits. The observed basal conditions do not closely correspond to those assumed in existing theories of sliding. (Humphreys-ISWS)
W79-08139

LONG-RANGE FORECAST OF THE STRENGTH OF THE MELTING ICE COVER IN THE VOLGOGRAD RESERVOIR IN SPRING,

K. N. Polyakova.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 217-221, 1977. 3 fig, 4 tab, 8 ref. Translated from Trudy Gidromettsentra SSSR, No. 184, p 64-72, 1977.

Descriptors: *Reservoirs, *Ice cover, *Strength, *Forecasting, Ice, Lake ice, Navigation, Melting, Temperature, Solar radiation, Mathematical models, *Volgograd Reservoir(USSR), *Volga River.

A cascade of reservoirs has been constructed on the Volga River. Of these, the farthest downstream is the Volgograd Reservoir, which determines the beginning of navigation on the Volga. The forecasts of the clearance of the reservoir from ice, issued at the present time, do not satisfy the requirements of navigation, which frequently begins before ice starts to drift. Therefore, it had become necessary to forecast the strength characteristics of the melting ice cover. Our main purpose was to develop a method for the long-range forecasting of the strength characteristics of ice in spring under which icebreakers or ice-breaking vessels of a certain class can navigate at a given speed in ice. The

investigations showed that ice cover thickness changes insignificantly in the first days of melting. However, liquid inclusions and layers between crystals form at that time inside the ice, producing a sharp decrease in its strength. The dates of occurrence of a given ice cover strength were used as initial data in deriving the prognostic relations. These dates were determined for 26 years. (Sims-ISWS)
W79-08151

SHORT-RANGE FORECASTS OF RIVER BREAKUP ON THE BASIS OF A GENERAL MODEL OF THIS PROCESS,
S. N. Bulatov, and T. P. Silant'yeva.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 211-216, 1977. 2 fig, 2 tab, 3 ref. Translated from Transactions of the Hydrometeorological Scientific Center of the USSR (Trudy GMTs), No. 184, p 4-14, 1977.

Descriptors: *Ice breakup, *Rivers, *Model studies, *Forecasting, Mathematical models, Analytic techniques, Analysis, Methodology, Ice, Melting, Heat budget, Ice cover, Equations, *USSR.

The model of ice cover destruction makes it possible to develop methods for the short-range forecasting of the breakup of rivers in various physiographic regions of the USSR and with different breakup characteristics. This model was adopted for developing methods for the short-range forecasting of the breakup of all the rivers of the Soviet Union, since the principle for obtaining a prognostic relation is the same for any river. The relation for forecasting the breakup dates of the Syr-Dar'ya River at Karmakchey gave an error of + or - 2 days, with a probability of 86% for an average range of 5 days. The probability of the permissible error of + or - 2 days in forecasts from these relations varies from 85-95% for an average range of 5 days. The deviations of the computed from actual breakup dates are sometimes greater in individual years, possibly because of the unreliability of the initial data. Thus, the method based on the heat budget of the melting ice, applied to the largest rivers of Soviet Central Asia, gives positive results. (Humphreys-ISWS)
W79-08154

AN APPLICATION OF COSMIC-RAY NEUTRON MEASUREMENTS TO THE DETERMINATION OF THE SNOW-WATER EQUIVALENT,
Institute of Physical and Chemical Research, Tokyo (Japan). Cosmic Ray Lab.
M. Kodama, K. Nakai, S. Kawasaki, and M. Wada.
Journal of Hydrology, Vol. 41, No. 1/2, p 85-92, April 1979. 5 fig, 6 ref.

Descriptors: *Snow, *Measurement, *Instrumentation, *Equipment, Depth, Density, Moisture content, Snowpacks, Snow cover, Water resources, Snow-water equivalent, Cosmic-ray snow gages, Neutron meters.

Application of the water absorption character of cosmic-ray neutrons to the determination of the water equivalent depth of a snow cover was shown. This device was called the cosmic-ray snow gauge. The attenuation curves of the cosmic-ray snow gauge set under or in water or snow were experimentally obtained. Continuous field observations of the snow depths during 4 snow seasons demonstrated the effectiveness of the present device even for a snow cover of more than 1 m water equivalent, where the relative accuracy was found to be a few percent of the water depth. Possible effects of primary cosmic rays, barometric pressure, and water content of soil upon the determination of snow depths were discussed. (Sims-ISWS)
W79-08251

MODELING ICE REGIME OF LAKE ERIE,
Ecology and Environment, Inc., Buffalo, NY.
A. Wake, and R. R. Rumer, Jr.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14694, p 827-844, July 1979. 13 fig, 1 tab, 30 ref, 1 append. NOAA 03-6-022-35235.

Descriptors: *Lake ice, *Model studies, *Great Lakes, *Lake Erie, Mathematical models, Computer models, Heat flow, Heat exchangers, Heat transfer, Temperature, Air temperature, Ice, Lakes, Water temperature, Freezing, Dispersion, Currents(Water), Meteorological data.

A thermodynamic model for ice formation, growth and dissipation was developed to simulate the ice regime of Lake Erie. The model utilizes the two-dimensional convective dispersion equation for the heat balance of the body of water and the interfacial heat exchange equations to account for the various heat exchange processes at the air-water, air-ice, and ice-water interfaces. The hydrodynamic transport of heat by the lake currents was approximated by computing a steady-state current field using a vertically-integrated equation of motion. The climatological data recorded at Buffalo, New York, for the winter of 1975-76 were used in the heat exchange computations. Although the model has not been verified nor sufficiently calibrated, the general patterns of the two-dimensionally displayed computed results are in close agreement with the limited observations. (Sims-ISWS)
W79-08262

2D. Evaporation and Transpiration

PAN EVAPORATION IN ARID ZONE OF INDIA USING THE PENMAN EQUATION WITH MODIFIED AERODYNAMIC TERM,
Rookee Univ. (India). Dept. of Hydrology.
S. M. Seth.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 208-211, Dec. 1977, 1 fig, 1 tab, 5 ref.

Descriptors: *Evaporation pans, *Evaporation, *Penman equation, Arid climates, Equations, Aerodynamic term, Energy equation, India.

Although the Penman method, which utilizes a combination of aerodynamic and energy balance equations, is the most widely used technique for computing evaporation, it has been shown to underestimate pan evaporation under arid conditions due to the low weightage given to the aerodynamic term. Accordingly, the present study examines the feasibility of using a modified aerodynamic term in the Penman equation for the arid zone of India. The results obtained using the data of Krishnan and Kushwaha indicate that this method is useful in accurately predicting pan evaporation. (Tickes-Arizona)
W79-08031

CALCULATION OF EVAPORATION DURING THE THREE STAGES OF SOIL DRYING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
S. B. Idso, R. J. Reginato, and R. D. Jackson.
Water Resources Research, Vol. 15, No. 2, p 487-488, April 1979. 1 fig, 6 ref.

Descriptors: *Evaporation, *Soil temperature, *Soil types, *Arizona, Soils, Climatic data, Climates, Solar radiation, Temperature, Air temperature, Equations, *Soil drying, *Daily evaporation rates, Incoming solar radiation, Reflected solar radiation, Avondale loam soil, Climatic conditions, Meteorological parameters.

A single equation was developed to calculate daily evaporation rates during all three stages of soil drying. The only required input data are daily incoming and reflected solar radiation and maximum and minimum air and soil surface temperatures. Experiments demonstrating the validity of the equation were conducted on an Avondale loam soil at Phoenix, Arizona, under a wide range of climatic conditions. It was shown that the effects of many important meteorological parameters are automatically accounted for by the direct measurement of the soil surface temperature. It remains to be seen if evaporation from other soils can be equally well described in this manner. (Roberts-ISWS)
W79-08138

A DIAGNOSTIC EXAMINATION OF A COMPLEMENTARY RELATIONSHIP BETWEEN ACTUAL AND POTENTIAL EVAPOTRANSPIRATION,
Waterloo Univ. (Ontario). Dept. of Geography.
E. F. LeDrew.
Journal of Applied Meteorology, Vol. 18, No. 4, p 495-501, April 1979. 1 fig, 3 tab, 20 ref.

Descriptors: *United States, *Canada, *Evapotranspiration, *Saturated soils, *Model studies, Saturated flow, Saturation, Water balance, Variability, Water loss, Climatic data, Watersheds(Basins), *Actual evapotranspiration, *Potential evapotranspiration, *Ireland, Five-year means, Experimental design, Variables, Radiant energy.

It was proposed by F. I. Morton in 1969 that the actual and potential evapotranspiration may behave in a complementary fashion about some definable constant as the regional surface dries from an initial saturated condition. This hypothesis was supported with an analysis of five-year means of water balance data for drainage basins in the United States, Canada, and Ireland. This paper examined the validity of the assumptions used in the derivation of this complementary relationship. The problem was approached by using a physically realistic diagnostic model of the energy fluxes within a closed system. The probable range of error attributable to eash assumption was evaluated from a data set derived from a series of model simulations. For the experimental design considered in the original hypothesis and replicated in the diagnostic model, it was concluded that specifying the sum of actual and potential evapotranspiration as a constant is physically unrealistic. The errors associated with this complementary relationship may be as large as the magnitude of the variable being estimated. (Roberts-ISWS)
W79-08245

DETERMINATION OF FOREST EVAPORTANSPIRATION USING BOWEN RATIO AND EDDY CORRELATION MEASUREMENTS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
D. L. Spittlehouse, and T. A. Black.
Journal of Applied Meteorology, Vol. 18, No. 5, p 647-653, May 1979. 7 fig, 1 tab, 36 ref.

Descriptors: *Evapotranspiration, *Forests, *Measurement, Winds, Anemometers, Heat flow, Energy budget, Energy transfer, Evaporation, Moisture, Temperature, On-site investigations, Data processing, Regression anaysis, Correlation analysis, Analytical techniques.

Rates of evapotranspiration from a 14 m high Douglas fir forest on the southwest cost of British Columbia were obtained using the energy balance/Bowen ratio method and an energy balance/eddy correlation method. In the former method, the Bowen ratio was measured using reversing diode psychrometers. In the latter, the sensible heat flux was obtained by eddy correlation analysis of data obtained from a fast response thermistor and Gill anemometers mounted horizontally and at 30 deg from the vertical. The generally low wind speed above the forest resulted in occasional stalling of the anemometers and made obtaining adequate eddy correlation data difficult. Spectral analysis of the eddy correlation data indicates that a significant fraction of the sensible heat flux was at low frequencies. The regression relationship between evaportanspiration rate obtained using the energy balance/eddy correlation method (E sub e) and that obtained using the energy balance/Bowen ratio method (E sub Beta) was found to be E sub e = 0.96 sub Beta - 0.02 (mm/h). The experiment suggested that an eddy correlation system using mechanical anemometers is not suitable for extended water balance studies of forests where low wind speeds predominate. (Sims-ISWS)
W79-08248

REAL AND POTENTIAL EVAPOTRANSPIRATION UNDER DIFFERENT SALINE CONDITIONS,

A. M. Balba, and M. F. Soliman.
Alexandria Journal of Agricultural Research, Vol. 26, No. 1, p 247-254, 1978, 5 tab, 10 ref.

Descriptors: *Evaportanspiration, *Environmental effects, *Crop response, Irrigation effects, Saline soils, Saline waters, Sudangrass.

The purpose was to compare the results obtained from an equation developed by FAO to calculate the potential ET of several crops in Egypt with those equations developed b Penman, Blaney-Criddle, and Hargraves, and to test the results and applicability of all 4 equations ET values obtained experimentally under different salinity conditions. Sudan grass was grown in 21 soil drums using a sand culture irrigated with a nutrient solution containing 0, 15, and 30 meg/L of NaCl, NaSo4 or CaCl2. Solutions were applied with a sub-irrigation technique which allowed for the determination of the real ET under each treatment. Experimental results indicated that the effects of saline solutions in irrigation waters varies with both salt concentration and composition and results in restricted growth, particularly of the roots, decreased surface area of the leaves, increased leaf water content and decreased ET. Potential ET values calculated with the FAO, Hargraves, Blaney-Criddle, and Penman equations were found to be 84.7, 61.8, 52.9 and 49.2% of the real ET of plants under nonsaline conditions respectively. It is concluded therefore that all 4 equations are necessarily limited to ET determinations with nonsaline waters and soils. (Tickes-Arizona)
W79-08347

2E. Streamflow and Runoff

DYNAMICS OF FORMATION OF THE CHANNEL OF THE KARA-KUM CANAL,
For primary bibliographic entry see Field 2J.
W79-08099

URBANIZATION IMPACT ON STREAMFLOW,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard, and S. Chang.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14623, p 647-659, June 1979. 3 fig, 5 tab, 4 ref, 1 append.

Descriptors: *Urbanization, *Texas, *Oklahoma, *Urban runoff, *Model studies, Mathematical models, Surface runoff, Permeability, Streamflow, Cities, Effects, Drainage, Rainfall, Precipitation(Atmospheric), Floods, Planning, Hydrology, *Tulsa(OK), *Oklahoma City(OK), *Dallas(TX), *Austin(TX), *Fort Worth(TX).

Studies of the impact of urbanization on runoff in the Tulsa metropolitan area were based on 114 floods recorded in Oklahoma City, Dallas, Fort Worth, and Austin, since satisfactory streamflow data were not available for Tulsa. It was found that impervious areas do not appreciably affect runoff timing, and they affect runoff volume much less than was anticipated. A model for computing urban runoff changes and calibration criteria were suggested, along with step-by-step procedure description. (Sims-ISWS)
W79-08107

GEOMETRY OF RIVERS IN REGIME,
San Diego State Univ., CA. Dept. of Civil Engineering.
H. H. Chang.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14640, p 691-706, June 1979. 9 fig, 24 ref, 2 append.

Descriptors: *Rivers, *Geomorphology, *Model studies, *Mathematical models, Braiding, Meanders, Channels, Canals, Roughness(Hydraulic), Regime, River beds, Sediments, Fluvial sediments, Sediment transport, Sediment load, Sedimentation, Flow, Flow resistance, Waterways.

An analytical method was developed for computing the self-adjusted geometry of sand-bed rivers based upon a sediment discharge formula, a flow resistance relationship, and the concept of minimum stream power. Regime rivers with low values of discharge Q and slope S are characterized by small width-depth ratios (generally less than 30) that are not sensitive to the change in slope or discharge. Most regime canals belong to this category. But for larger values of Q or S, or both, the results showed that regime rivers may have large, width-depth ratios sensitive to the changes in Q or S. As Q or S increases, the width-depth ratio of a regime river may become so large that it indicates a braided channel pattern. However, a much smaller width-depth ratio under this situation is also a possible stable geometry. The stable geometry was obtained from the stream power analysis wherein each stable configuration was assumed to correspond to a minimum stream power for the given constraints. (Sims-ISWS)
W79-08108

A NOTE ON THE POISSON ASSUMPTION IN PARTIAL DURATION SERIES MODELS,
Ireland Office of Public Works, Dublin.
C. Cunnane.
Water Resources Research, Vol. 15, No. 2, p 489-494, April 1979. 2 fig, 1 tab, 8 ref.

Descriptors: *Flood frequency, *Flood peak, *Model studies, *Mathematical models, Floods, Flow, Mathematics, Analytical techniques, Hydrology, *Poisson models, Poisson assumption.

The Poisson process is frequently encountered in probability models of the partial duration series. This paper looked at the necessity for specifying the model in detail by such a process and also examined the validity of the Poisson distribution, in the context, as judged on data from 26 gaging stations on 20 catchments in Great Britain. When all the data are considered jointly, the Poisson assumption has to be rejected, although it is acceptable in some cases. It was also suggested that if dependence exists in the partial duration series it should be looked for in the point process from which the series arises rather than among successive peak magnitudes. (Sims-ISWS)
W79-08109

TRIBUTARY DIAMETER IN TOPOLOGICALLY RANDOM CHANNEL NETWORKS,
Brock Univ., St. Catharines (Ontario). Dept. of Geological Sciences.
J-J. Flint, and J. R. Proctor.
Water Resources Research, Vol. 15, No. 2, p 484-486, April 1979. 3 tab, 9 ref.

Descriptors: *Tributaries, *Channels, *Networks, *Model studies, Mathematical models, Topography, Streams, Drainage, Watersheds(Basins), Hydrologic systems, Hydrology, Channel networks, Random channel networks, Tributary diameter.

The concept of channel diameter can be extended to define the number of links along the trunk channel of tributaries in a basin. In topologically random channel networks, the occurrence of tributaries with a specified diameter can be expressed by recursive equations for basins of given magnitude. Comparison with two sets of stream data indicated a close resemblance with calculated values. (Sims-ISWS)
W79-08110

PROCEEDINGS OF A SEMINAR ON NONSTRUCTURAL FLOOD PLAIN MANAGEMENT MEASURES,
Hydrologic Engineering Center, Davis, CA.
K. E. McIntyre, G. D. Cobb, F. H. Thomas, G. E. Dickey, and D. B. Duncan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 607, Price codes: A10 in paper copy, A01 in microfiche. Seminar held at the Institute for Water Resources, Fort Belvoir, Virginia, May 4-6, 1976. Report HEC-SP-08, 1976. 193 p, 24 fig, 21 tab, 23 ref.

Descriptors: *Flood control, *Flood plains, *Flood protection, *Nonstructural alternatives, *Project planning, *Legal aspects, *Systems analysis, *Planning, *Flood plain management, Water management(Applied), Flood proofing, Flood damage, Flood plain acquisition, Water policy, Zoning, Land use, Water resources development, Administration, Economics, Benefit/cost analysis.

This report contains 16 papers pertaining to a variety of technical, institutional and political problems associated with implementation of nonstructural flood plain management measures. Nonstructural measures offer a wide range of opportunities to reduce flooding. Recommendations for achieving a unified national flood plain management program include greater Federal agency consistency in flood hazard evaluation; interagency cooperation in reviewing flood information requests; and the issuance of flood hazard guidelines once a year. Nonstructural flood control planning procedures include evaluation of benefits based on project outputs and institution of a cost sharing policy for environmental quality aspects of nonstructural measures programs. Better community dissemination of nonstructural flood measures, and Federal aid in flood plain land acquisition are suggested. Ongoing programs in the Northeast, South, and Pacific regions are discussed. The seminar highlighted the need for analytical tools to perform flood damage analysis; land use analysis for future development; social/institutional analysis, particularly of community financial capability; and development of a data management system in flood prone areas well suited to nonstructural flood measure planning. A final overview proposes the need for additional guidance in defining planning objectives and institutional roles consistent with national nonstructural flood measures objectives; further refinement/improvement of traditional benefit/cost analysis; and the need for an interdisciplinary approach in flood hazard management and analysis of local nonstructural flood protection needs. (Arnold-NC)
W79-08173

ENVIRONMENTAL PLANNING FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON. PART II. URBAN DRAINAGE STUDY. APPENDIX C:STORM WATER MONITORING PROGRAM,
Army Engineer District, Seattle, WA. Seattle District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 168, Price codes: A06 in paper copy, A01 in microfiche. Report, December 1974. 107 p, 5 append. 22 tab, 58 fig.

Descriptors: *Urban runoff, *Storm runoff, *Urban drainage, *Seattle(WA), *Green River Basin(WA), *Cedar River Basin(WA), *Environmental management, Washington, Overland flow, Storm water, Surface runoff, Storm drains, Effective precipitation, Unit hydrographs, Urbanization, Water pollution sources, Water pollution, Water quality, Waste water(Pollution), Washouts, Management.

This is part of an integrated study of water and waste management sponsored by the City of Seattle. The study was designed to provide a drainage management plan for use in development of an integrated environmental management plan for the Green and Cedar River Basins. This Appendix reports the results of a seven-month stormwater runoff study of the Seattle metropolitan area. Both quantity and quality of the runoff is assayed. Quantity was continuously measured by monitoring stormwater runoff and rainfall volume and intensity. Quality measurements were made for 29 parameters at specified intervals over six months. Rainfall runoff factors were low--ranging from 5% for low density residential areas to 64% for commercial areas--probably due to light rainfall intensity during the testing period. Pollutant washoff increased by land use, ranging from the lowest recordings for single family residential to new commercial to industrial to multiple residential to the highest recordings for old commercial areas. Major pollutants were solids, BOD, COD and oil. Nutrient and heavy metal loadings were low; coliform recordings in a sanitary sense were insignificant. Recommendations include extending the monitoring program, establishing a more complete

rain gauge network, sampling higher intensity storms, studying street pollutant buildups, improving calibration methods, using automatic sampling equipment and better analysis of the data. (Zayac-NC)
W79-08181

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, NILES-MCDONALD-GIRARD-WEATHERSFIELD TOWNSHIP.
Army Engineer District, Pittsburgh, PA.
Prepared for the Mahoning-Trumbull Council of Governments, Trumbull County Planning Commission, and the Ohio Dept. of Natural Resources, June 1972. 30 p, 2 fig, 10 plates, 6 tab.

Descriptors: *Floods, *Regional flood, *Historic floods, *Flood data, *Ohio, *Mahoning River(OH), *Trumbull County(OH), Overflow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Storms, Flood stages, Peak discharge, Rivers, Floodways, Flood protection, Warning systems, Control structures, Dams, Mosquito Creek(OH), Meander Creek(OH), Intermediate regional flood, Niles(OH), Girard(OH).

This report presents flood plain information for the Mahoning River near the townships of Niles, McDonald, Girard, and Weathersfield in Trumbull County, Ohio. The drainage area of this part of the study area of the river is 888.2 square miles at the downstream limits. Averaging 20 miles in length, the entire watershed of the study reach is about 30.6 miles wide, and includes the tributaries of Meander Creek and Mosquito Creek. Development in the flood plain includes several railroad tracks subject to periodic flooding, three highways, and residential, industrial, and commercial development. Moderate expansion of development and facilities is projected and periodic flooding is predicted. The flood season extends from December to April, with most flooding resulting from heavy rain and snow melt. Data were obtained from U.S. Geological Survey and Corps of Engineers stream gages, newspaper files and historical documents and records. Major obstructions to flood flow include trees, brush, and other stream bank vegetation. The largest recorded flood occurred in March 1913, discharging 44,400 cubic feet per second (cfs) at the Youngstown gage, and reaching a height of 26.5 feet above flood stage. More recently serious flooding occurred in January 1959, with a discharge of 17,600 cfs at the Youngstown gage, reaching a height of 18.6 feet above flood stage. The Intermediate Regional Flood would discharge 21,000 cfs at the Youngstown gage. Flood control measures include three dams upstream of the study reach plus a fourth in Youngstown, downstream of the reach. No nonstructural flood measures beyond flood warning and forecasting and emergency evacuation plans have been established. (Arnold-NC)
W79-08187

FLOOD PLAIN INFORMATION: MAHONING RIVER AND CRAB CREEK, MAHONING COUNTY, OHIO, YOUNGSTOWN-CAMPBELL-STRUTHERS-LOWELLVILLE,
Army Engineer District, Pittsburgh, PA.
Prepared for the Mahoning-Trumbull Council of Governments and the Ohio Department of Natural Resources, June 1972. 36 p, 6 fig. 14 plates, 6 tab.

Descriptors: *Ohio, *Floods, *Regional flood, *Historic floods, *Flood data, *Flood protection, *Mahoning River(OH), *Mahoning County(OH), Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Storms, Flood stages, Peak discharge, Rivers, Floodways, Warning systems, Control structures, Dams, Reservoirs, Crab Creek(OH), Intermediate regional flood.

This report presents flood plain information for the Mahoning River and Crab Creek within Mahoning County, PA. It includes the communities of Youngstown, Campbell, Struthers and Lowellville. The drainage area of the downstream limit of the study reach is 1066.8 square miles. Heavy industrial development exists in the flood plain, especially around Youngstown. Six railroads and three highways parallel the banks of the Mahoning River. Flood information was obtained from stream gaging stations operated by the U.S. Geological Survey, from newspaper files, historical documents and records. The flood season extends from December to April, with most flooding resulting from heavy rain and snow melt. Three multi-purpose dams in the basin upstream of the report reach reduce major floods in the area by an average of 3 to 6 feet. Duration of flooding is short on Crab Creek, usually less than 24 hours, but on the Mahoning River it may approach three days in length. The largest flood in the area's history occurred in March 1913, discharging 44,400 cubic feet per second (cfs) at the Youngstown gage, and reaching a height of 26.5 feet above flood stage. More recently, the January 1959 flood discharged 17,600 cfs, rising to 18.6 feet above flood stage. The Intermediate Regional Flood (IRF) would discharge 21,000 cfs at the Youngstown gage. This report is intended as a basis for adoption of land use controls to guide flood plain development. (Arnold-NC)
W79-08188

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, CITY OF WARREN-LEAVITTSBURG, WARREN AND HOWLAND TOWNSHIPS,
Army Engineer District, Pittsburgh, PA.
Prepared for the Mahoning-Trumbull Council of Governments, Trumboff County Planning Commission, and the Ohio Dept. of Natural Resoucres. June 1972. 28 p, 2 fig, 10 plates, 6 tab.

Descriptors: *Ohio, Floods, *Regional flood, *Historic floods, *Flood data, *Mahoning River(OH), *Trumbull County(OH), Overflow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Storms, Flood stages, Peak discharge, Rivers, Floodways, Flood protection, Warning systems, Control structures, Dams, Intermediate regional flood, Howland(OH), Warren(OH).

This report presents flood plain information for the Mahoning River within Warren and Howland Townships in Trumbull County Ohio. The drainage area of the downstream limit of the study reach is 612.8 square miles. Averaging 20 miles in length, this study section of the watershed is about 30.6 miles wide, and includes the tributaries of West Branch-Mahoning River, Eagle Creek, Duck Creek, Meander Creek, and Mosquito Creek. Development in the flood plain is urban residential, commercial, and industrial. The study reach is flanked by five roads and a stretch of railroad. Three city parks border this stretch of the river. The flood season extends from December to April, with most flooding resulting from heavy rain and snow melt. Major obstructions to flood flow include trees, brush, and other streambank vegetation. Data were obtained from U.S. Geological Survey and Crops of Engineers gaging stations, newspaper files, and historical documents and records. The largest recorded flood occurred in March 1913, discharging 33,700 cubic feet per second (cfs) at the Warren gage, and reaching a height of 21.1 feet above flood stage. More recently, serious flooding occurred in January 1959, with a discharge of 16,000 cfs, rising to 16.7 feet above flood stage. By contrast, the Intermediate Regional Flood (IRF) for the study reach would discharge 16,8000 cfs. Velocities of flow would vary from 3 feet per second overbank flow to main channel speeds of 9 feet per second. Flood control measures include two dams upstream of the study reach. No nonstructural measure beyond flood warning and forecasting and emergency evacuation plans have been established. (Arnold-NC)
W79-08189

SPECIAL FLOOD HAZARD INFORMATION REPORT: WALNUT CREEK, MANSFIELD, TEXAS,
Army District, Fort Worth, TX.
Prepared for the City of Mansfield, Texas July 1973. 16 p, 2 fig, 5 plates, 2 tab.

Descriptors: *Texas, *Floods, *Flood protection, *Walnut Creek(TX), *Mansfield(TX), *Flood plain management, Flooding, Historic floods, Flood frequency, Flood stages, Peak discharge, Rivers, Floodways, Flood plains, Standard project flood, Flood plain zoning, Warning systems, Building codes, Land use, Planning, Zoning, Control structures, Floodproofing, Intermediate regional flood.

This report details flood information for the Walnut Creek watershed near Mansfield, Texas, about 10 miles southeast of Fort Worth. A drainage area of about 85.6 square miles. the basin experienced serious flooding in the spring seasons of 1969 and 1973. There are no official gaging stations in the area. Peak discharge on Walnut Creek below Hogpen Branch was 24,000 cubic feet per second (cfs). The 100-year (Intermediate Regional) Flood would increase water depth up to 22 feet in excess of normal streambed depth. Concern exists for the City of Mansfield, which grew in population by 37% between 1970 and 1973, with some housing construction and economic development encroaching on the floodplain. Although no flood control structures existed on the creek at the time of the report, Corps of Engineers construction of the Lakewiew Dam on nearby Mountain Creek might affect Walnut Creek. Guidelines for floodplain management are presented, including selective zoning with designation of encroachment lines delineating the floodway zone, narrowing the floodway to accommodate controlled economic development in the adjacent floodplain, institution of new subdivision regulations, floodproofing existing structures, establishing regulations to control sewage disposal in the floodway, developing faster and more accurate flood forecasting, and creating development policies which would control extension of public services into the flood hazard area. The purpose of the report is to define the flood risk involved in development of the area studied. (Arnold-NC)
W79-08190

SPECIAL FLOOD HAZARD INFORMATION REPORT: WHITE OAK CREEK, DIBOLL, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Diboll, Texas July 1973. 14 p, 1 fig, 2 plates, 2 tab.

Descriptors: *Texas, *Floods, *Flood protection, *Diboll(TX), *White Oak Creek(TX), Flooding, Flood profiles, Historic floods, Flood data, Flood stages, Peak discharge, Flood peak, Rivers, Flood plains, Flood plain zoning, Flood plain insurance, Building codes, Land use, Planning, Zoning, Control structures, Floodproofing, Intermediate regional flood, Neches River(TX), Angelina County(TX), Flood plain management.

This report gives flood information for the portion of the White Oak Creek watershed from just north of the city of Diboll, 5.5 miles southwest to its confluence with the Neches River near the U.S. Highway 59 crossing. The basin lies about 150 miles southeast of the Dallas metropolitan area. A drainage area of about 7.6 square miles, White Oak Creek is prone to occasional flooding. The watershed averages about 1.4 miles in width. No major developments exist in the watershed. No gaging information is available for the creek, but based upon records of nearby streams, estimated peak flow is 7,700 cubic feet per second (cfs) for the Intermediate Regional Flood (IRF) at State Highway 59. Major causes of flooding are from frontal-type storms in the spring, although intense thunderstorms may occur at any time during the year. The IRF is calculated to top three of the five bridges in the study area. No flood control or structural measures were in effect at the time of this report. The study presents guidelines for floodplain management, including nonstructural measures such as selective zoning for the floodway and the adjacent flood plain; subdivision regulations and building codes for the flood plain; better control over sewage waste disposal; more accurate and timely flood forecasting; and development policies controlling the extension of public services into the flood hazard areas of the White Oak Creek Basin. (Arnold-NC)

W79-08191

FLOOD HAZARD ANALYSES, CARIBOU STREAM, CITY OF CARIBOU, AROOSTOOK COUNTY, MAINE,
Soil Conservation Service, Orono, ME.
Report, September 1977, 10 p, 11 plates, 3 tab, 8 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Control structures, *Dams, *Caribou Stream(ME), *Caribou(ME), *Aroostook County(ME), Floods, Indirect flood measurement, Storms, Hurricanes, Historic floods, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain insurance, Farnham Brook(ME), Mile Brook(ME), 100-year flood, 500-year flood.

This report details flood hazard areas along 3.2 miles of the Caribou Stream and its tributaries: 0.4 mile of Farnham Brook and 1.4 miles of Mile Brook in the vicinity of the City of Caribou. Caribou is located in northeastern Aroostook County in the northeastern section of Maine. The Caribou Stream Watershed has a drainage area of about 50 square miles from its headwaters east to its confluence with the Aroostook River at Caribou. Average flood plain width is approximately 500 feet. The portion of the study reach along the Caribou Stream has an average slope gradient of about 0.004 ft/ft or 21.1 ft/mile. Development in the flood plain includes residential, agricultural, and commercial uses. Caribou is experiencing increasing urbanization and development pressures will continue to increase. Flood history was obtained from newspaper records. No gage information is available. Flooding is due primarily to spring rains and snowmelt runoff. Major floods occurred in May 1923, September 1954 (from Hurricane effects), and in April 1973. The 1954 flood, bringing six inches of rainfall, was equivalent to the 100-year flood and 6-7 feet for the 500-year flood. The report recommends establishment of a flood plain management program. The study area participates in the National Flood Insurance Program. (Arnold-NC)
W79-08192

FLOOD HAZARD ANALYSES: LITTLE OSSIPEE RIVER, TOWN OF LIMINGTON, MAINE - YORK COUNTY.
Soil Conservation Service, Orono, ME.
Report, September 1977, 6 p, 14 plates, 2 tab, 8 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Dams, *Little Ossipee River(ME), *Limington(ME), *York County(ME), *Control structures, Floods, Regional flood, Indirect flood measurement, Historic floods, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain insurance, Zoning, 100-year flood, 500-year flood, Saco River(ME).

This report details flood hazard areas along an 11-mile stretch of the Little Ossipee River in the vicinity of Limington in York County, Maine. The Little Ossipee River watershed has a drainage area of about 185 square miles near its confluence with the Saco River in East Limington. Major land uses in the flood plain are woodland and water-based recreation areas. There are no urban centers located adjacent to the flood plain, but significant development pressure exists for construction of permanent and seasonal homes within the flood plain area. A U.S. Geological Survey gage is located on the Little Ossipee River near South Limington. The highest recorded discharge at the gage occurred in May 1954, measuring 5,300 cubic feet per second (cfs). Flooding occurs almost annually and is caused primarily by spring snowmelt runoff and summer rainfall. The flood of record occurred in March 1936, discharging 8,530 cfs just upstream of the study area. This discharge slightly exceeded the predicted 100-year flood. No records of significant flood damage exist. Estimated peak discharges for the 100-year and 500-year floods are 7,760 cfs and 11,800 cfs at the U.S. Geological Survey gaging station. Maximum height above flood stage would be about 4-5 feet for the 100-year flood and 6-7 feet for the 500-year flood. Flood control measures include dams and spillways at five locations and participation in the National Flood Insurance Program. The report is intended to provide a technical basis for instituting flood plain management programs. (Arnold-NC)
W79-08193

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWN OF SOUTH BERWICK, MAINE, YORK COUNTY,
Soil Conservation Service, Orono, ME.
September 1977, 6 p, 17 plates, 2 tab, 9 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Control structures, *Dams, *South Berwick(ME), *Great Works River(ME), *York County(ME), Floods, Regional flood, Historic floods, Indirect flood measurement, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain zoning, Flood plain insurance, Zoning, Boyd Brook(ME), Chicks Brook(ME), White Marsh Brook(ME), 100-year flood, 500-year flood.

This report details flood hazard information for that 13-mile portion of the Great Works River from the Town of South Berwick, Maine, south to its confluence with the Salmon Falls River on the New Hampshire border, and includes the tributaties of Boyd Brook, Chicks Brook, and White Marsh Brook. The drainage area of the Great Works River is 86 square miles within York County, Maine. Average flood plain width is defined as 500 feet. Major land uses in the flood plain are woodland and agriculture. Three dams are located in the study area; there are also 10 bridges and one pipeline. Due to the study reach's proximity to the Town of South Berwick, increasing urbanization and development in the flood plain are likely to occur. No gage data are available. Flooding is caused primarily by spring snowmelt runoff and summer rainfall. The flood of March 1936 is considered the largest in recent years; a flow discharge equivalent to the 100-year flood occurred. No records of significant flood damage exist for this area. Estimated peak discharges for the 100-year and 500-year floods are 8,101 cubic feet per second (cfs) and 11,000 cfs, respectively. Maximum height above flood stage would be an average of 4-5 feet for the 100-year flood and 6-7 feet for the 500-year flood. The 500-year flood would overtop three bridges and one road in the area. Three dams help control flood flows; South Berwick participates in the National Flood Insurance Program. This report is intended to provide a technical basis for developing a flood plain management program. (Arnold-NC)
W79-08194

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWNS OF NORTH BERWICK AND SANFORD, MAINE - YORK COUNTY,
Soil Conservation Service, Orono, ME.
Report, September 1977, 6 p, 20 plates, 2 tab, 9 ref.

Descriptors: *Maine, *Flood profiles, *Rivers, *Control structures, *Dams, *North Berwick(ME), *Sanford(ME), *Great Works River(ME), *York County(ME), Floods, Regional flood, Indirect flood measurement, Historic floods, Flood data, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain zoning, Flood plain insurance, Zoning, Goodall Brook(ME), 100-year flood, 500-year flood.

This report identifies and details flood hazard areas along a 14-mile stretch of the Great Works River and 1 mile of Goodall Brook in the vicinity of the towns of North Berwick and Sanford, York County, Maine. The Great Works River watershed has a drainage area of 86 square miles. Average flood plain width is defined as about 500 feet. Land use in the flood plain consists mostly of woodland and agriculture; twelve highway bridges, one railroad bridge, and three dams are located within the study reach. Increasing urbanization and resulting pressure on the flood plain are predicted from future growth of the towns of Sanford and North Berwick. No gage data are available. Flooding is caused primarily by spring snowmelt runoff and summer rainfall. The largest flood is considered to be the flood of March 1936, when a flow discharge equivalent to the 100-year flood occurred. No records of significant flood damage exist for this area. Estimated peak discharges for the 100-year and 500-year floods are a maximum of 3,640 cubic feet per second (cfs) and 5,180 cfs, respectively. Maximum height above flood stage would be an average of 4-5 feet for the 100-year flood and 6-7 feet for the 500-year flood on the study reach. The 500-year flood would overtop five bridges in the area. Flood control measures include three dams; the towns of Sanford and North Berwick participate in the National Flood Insurance Program. This report is intended to provide a technical basis for developing a flood plain management program. (Arnold-NC)
W79-08195

ON THE EFFECT OF PRECIPITATION AND RUNOFF ON COASTAL CIRCULATION IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2L.
W79-08237

ZONALITY OF GROUND-WATER RUNOFF UNDER HUMID CONDITIONS,
For primary bibliographic entry see Field 2F.
W79-08284

ANALYSIS OF UNCERTAINTY IN FLOOD PLAIN MAPPING,
Washington Univ., Seattle. Dept. of Civil Engineering.
S. J. Burges.
Water Resources Bulletin, Vol. 15, No. 1, p 227-243, February 1979. 2 fig, 2 tab, 23 ref, 2 append. OWRT A-097-WASH(1).

Descriptors: *Flood plains, *Mapping, *Risks, *Urbanization, *Planning, Statistical methods, Flood plain zoning, Flood frequency, Non-structural alternatives, Methodology, Decision making, *Flood plain mapping, First order uncertainty analysis, Flood plain geometry, Flood frequency distributions.

Components contributing to uncertainty in the location of the floodplain fringe of a mapped floodplain were identified and examined to determine their relative importance. First-order uncertainty analysis was used to provide a procedure for quantifying the magnitude of uncertainty in the location of the floodplain fringe. Application of the procedure indicated that one standard deviation of uncertainty in floodplain inundation width was about 1/3 of the mean computed inundation width for several floodplain geometry combinations. Suggested mapping criteria, which directly incorporate uncertainty estimates, were given. While these criteria are more suitable for use in developing areas than in floodplains that have had extensive development, the analysis procedure can be used to accommodate property owners who challenge the validity of estimated flood fringe boundaries. Use of uncertainty analysis in floodplain mapping should enhance the credibility of the final plan. (Singh-ISWS)
W79-08340

LOW-FLOW CHARACTERISTICS OF SMALL STREAMS IN PROPOSED PUBLIC LAW 566 BASINS,
Geological Survey, Madison, WI. Water Resources Div.
S. J. Field.
Geological Survey open-file report 78-664, October 1978. 32 p, 2 fig, 16 tab, 7 ref.

Descriptors: *Low flow, *Streamflow forecasting, *Low-flow frequency, *Regression analysis, *Wisconsin, Small watersheds, Gaging stations, Base flow, Evaluation.

Low-flow characteristics of small streams at 278 sites in 32 basins in Wisconsin which are being considered for work under Public Law 566 are presented. The low-flow characteristics are the annual minimum 7-day mean flow below which the flow will fall on the average of once in 10 years

and the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years. The low-flow characteristics at these sites were determined by correlating base-flow measurements at the ungaged sites to the concurrent daily mean flow at continuous-record gaging stations in the area. The statewide average of the accuracy determined by the standard error of estimate for the 10-year low flow, based on three base-flow measurements, is 45 percent but differs within the State. (Woodard-USGS)
W79-08388

SELECTED STREAMFLOW DATA FOR THE DELAWARE RIVER BASIN,
Geological Survey, Trenton, NJ. Water Resources Div.
R. D. Schopp, and B. D. Gillespie.
Geological Survey open-file report 79-347, February 1979. 16 p, 8 fig, 3 tab, 7 ref.

Descriptors: *Hydrologic data, *Delaware River, *Streamflow, Rainfall-runoff relationships, *Low flow, Natural flow, Gaging stations, Duration curves, Hydrographs, Isohyets, Frequency analysis, Correlation analysis, Damsites, Tributaries, Pennsylvania, New Jersey, New York.

Selected streamflow data for the Delaware River basin include runoff-precipitation relationships for 28 selected subbasins for the period 1941-70; low-flow frequency curves for four mainstem Delaware River sites; monthly comparative duration curves and twenty year hydrographs at Montague and Trenton, New Jersey; and flow duration tables based on observed daily streamflow for gaging stations near 21 proposed dam sites. (Woodard-USGS)
W79-08389

MAGNITUDE AND FREQUENCY OF FLOODS FOR SMALL WATERSHEDS IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08397

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA FOR STATIONS DISCONTINUED BEFORE 1978,
Geological Survey, Helena, MT. Water Resources Div.
R. J. Omang, J. A. Hull, and C. Parrett.
Geological Survey open-file report 79-510, May 1979. 117 p, 2 fig.

Descriptors: *Peak discharge, *Floods, *Crest-stage gages, *Small watersheds, *Montana, Surface runoff, Streamflow, Flood peak, Basic data collections.

Annual peak stage and discharge data have been tabulated for crest-stage gage sites in Montana. The crest-stage program was begun in July 1955 to investigate the magnitude and frequency of floods from samll drainage areas. The program has expanded from 45 crest-stage gaging stations initially to 172 stations maintained in 1978. From 1955 to 1978, 156 stations have been discontinued. This report is a tabulation of the stage and discharge data for the discontinued stations. (Woodard-USGS)
W79-08398

STRATEGIES FOR RESERVING FLOWS FOR FISH AND WILDLIFE: IDENTIFICATION, DESCRIPTION, AND PRELIMINARY EVALUATION,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W79-08401

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX E--FLOOD CONTROL.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6F.
W79-08438

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 3, LOGAN AND CHOCTAW BAYOUS,
Army Engineer District, New Orleans, LA.
Prepared For City of Shreveport, LA, April 1974, 33 p, 15 fig, 19 plates, 6 tab.

Descriptors: *Floods, Historic floods, *Flood data, *Flood stages, *Peak discharge, *Shreveport(LA), *Logan Bayou(LA), Flooding, Flood flow, Indirect flood measurement, Flood profiles, Flood frequency, Flow duration, Stage-discharge reglations, Rivers, Flood plains, Standard project flood, Warning systems, Intermediate regional flood, *Louisiana.

This report gives flood information on the Logan and Choctaw Bayous northwest of Shreveport, Louisiana. The Logan Bayou has a drainage area of 19.6 square miles with an average streambed slope of 11.6 feet per mile, while the drainage of the Choctqw Bayou is 14.8 square miles with a slope gradient of 7.5 feet per mile. Flood plain sidth varies from about 300-700 feet. There is little development other than grazing andfarming in the flood plain, although future urban expansion is predicted. Floods due to heavy rains can occur in any season. Data were obtained from stream gages, newspaper files, higtorical documents and records. There are no flood damage reduction measures in the study area. Large floods have occurred in the area but little specific data are available. The Intermediate Regional Flood (IRF) would discharge 7,600 cubic feet per second (cfs) on Logan Bayou, and 6,800 cfs on Choctaw Bayou, while the Standard Project Flood (SPF) would discharge 13,900 cfs and 11,800 cfs on Logan and Choctaw Bayous, respectively. Maximum rates of rise for the IRF are 1.9 ft/hr on Logan Bayou and 2.2 ft/hr on Choctaw Bayou, and for the SPF, 1.1 ft/hr and .05 ft/hr for Logan and Choctaw Bayous, respectively. Obstructions to floodlow include vegetation, dams and bridges. A major flood occurred in the area in November 1969 after a 7-inch rainfall. This report is intended as an aid in land use planning and management decisions concerning flood plain utilization. (Arnold-NC)
W79-08446

FLOOD PLAIN INFORMATION: CUYAHOGA RIVER, MANTUA AND HIRAM, PORTAGE COUNTY, OHIO,
Army Engineer District, Buffalo, NY.
Prepared for Ohio Department of Natural Resources - Water Division, and Tri-County Regional Planning Commission, April 1972, 47 p, 8 fig, 10 plates, 8 tab.

Descriptors: *Ohio, *Floods, *Historic floods, *Flood stages, *Flood data, *Peak discharge, *Cuyahoga River(OH), *Mantua(OH), *Hiram(OH), *Portage County(OH), Flooding, Flood flow, Indirect flood measurement, Flood forecasting, Flood profiles, Flow duration, Stage-discharge relations, Rivers, River beds, Floodways, Flood plains, Channels, Standard Project Flood, Flood protection, Control structures, Reservoirs, Intermediate Regional Flood.

This report covers a 7.6 mile area of the Cuyahoga River including the village of Mantua and Hiram Townships in Northeastern Ohio. Little development had taken place at the time of the report, although future growth of the nearby city of Akron would exert pressure for expansion into the floodplain. Data were obtained from a U.S. Geological Survey gage at Hiram Rapids, interviews, newspaper files and historical records. Flooding is caused by spring snowmelt and intense summer and fall thunderstorms. Obstructions to floodflow include inadequate bridge areas, and abandoned dams and natural obstructions. The largest recorded flood occurred in January 1959, discharging 3,800 cubic feet per second (cfs) and cresting at 8.1 feet above flood stage. The Intermediate Regional Flood (IRF) would discharge 5,100 cfs and crest at 9.3 feet, while the Standard Project Flood (SPF) would discharge 18,300 cfs and crest at 18 feet. At the time of the report, no flood plain management program existed for the area, although one is recommended. Two reservoirs on the study reach regulate river flow. (Arnold-NC)
W79-08447

FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER AND RIPPLE RIVER, AITKIN, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for The City of Aitkin, Minnesota, June 1975, 33 p, 23 fig, 22 plates, 4 tab.

Descriptors: *Minnesota, *Floods, *Indirect flood measurement, *Flood profiles, *Historic floods, *Flood stages, *Peak discharge, *Aitkin(MN), *Mississippi River(MN), *Ripple River(MN), Runoff, Flood flow, Flood forecasting, Flood data, Flood frequency, Stage-discharge relations, Rivers, River beds, Floodways, Standard project flood, Flood protection, Warning systems, Control structures, Levees, Reservoirs, Diversion structures, Channel improvement, Intermediate regional flood.

The study area covered by this report is the portion of Aitkin subject to flooding from the Mississippi and Ripple Rivers in central Minnesota. The study reach includes a 14.8 mile length of the Mississippi and a 5.8 mile length of the Ripple River. Development in the flood plain includes small industry, residential, some recreation facilities and the city sewage treatment plant. A gage is located on the Mississippi at the town of Atikin. Major cuases of flooding are runoff from spring snowmelt and occasional prolonged periods of summer rainfall. Obstructions to the flood flow include dams and bridges. Flood protection measures include a channel diversion project on the Mississippi, limited protection from four federal reservoirs, earth levees, and flood warning and forecasting. The 1975 flood had a peak of 7,800 cubic feet per second, and crested 18.0 feet above flood stage. The greatest recorded flood occurred in May 1950, with a peak discharge of 20,000 cfs, equivalent to that of the Standard Project Flood (SPF). The Intermediate Regional Flood (IRF) would discharge 10,700 cfs and crest 21.6 feet above flood stage. The SPF would crest at 25.0 feet, in contrast to the 1950 flood, which crested at 22.5 feet. This report furnishes a suitable basis for adoption of land use controls to guide flood plain development. (Arnold-NC)
W79-08448

SOME MIDSUMMER DIATOM ASSEMBLAGES ALONG THE SALINE GRADIENT OF A SMALL COASTAL STREAM IN KACHEMAK BAY, ALASKA,
Rutgers - The State Univ., Newark, NJ. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W79-08494

2F. Groundwater

COST OF WELL WATER IN COIMBATORE REGION,
Tamil Nadu Agricultural Univ., Coimbatore (India).
R. K. Sivanappan, and P. K. Aiyasamy.
Irrigation and Power, Vol. 35, No. 4, p 509-514, Oct. 1978. 5 tab, 1 fig, 6 ref.

Descriptors: *Wells, *Groundwater, *Well data, *Pumping, *Alternative planning, *Regional development, *Regional analysis, *Economic feasibility, *Cost analysis, Well regulations, Water conservation, Irrigation engineering, Water resources development, Overdraft, India, Planning, Drawdown.

Wells can appropriately be called the heart of life in the Coimbatore region of India where the number of wells, already amounting to more than 1,500,000 in 1971 is rapidly increasing with a growing dependence upon groundwater resources. Often indiscriminately placed and poorly designed, these wells are seriously jeopardizing the future of

these same resources and necessitating an evaluation of the overall situation and the cost under these circumstances of irrigation. An attempt is made here to provide such an analysis based upon a few selected case studies with the purpose of formulating policy measures to ensure short run benefits and safeguard long term conservation efforts. Information concerning well dimension, year of construction, investments made, irrigation potentials and area covered over seasons were collected through farmer interviews for 10 selected wells in existence for 3 decades within a radius of 15 km of Coimbatore. Results indicated that (1) well depth has consistently increased during periods of low rainfall, (2) well size at ground level has been decreased to prevent caving and reduce investment cost, (3) average discharge ranged from 20,000 to 67,500 liters per hour with the lower flows occuring during the summer months, and (4) supplemental engines were added to sustain lifting power. Although hampered by the extreme variability of several factors and a lack of quality data, a complete economic analysis including overhead costs, investment outlays, charges on depreciation of pumping machinery and equipments, charges paid for electric consumption and annual maintenance and repair charges is presented. Policy suggestions based upon the accumulated information are reviewed. (Tickes-Arizona)
W79-08024

GROUND WATER RESOURCES IN SEMI ARID AREA OF COIMBATORE DISTRICT, TAMIL NADU,
Afpro Git, Varanasi (India).
P. Loganathan.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 182-184, Dec 1977. 2 fig, 1 tab, 2 ref.

Descriptors: *Well data, *Groundwater resources, *Water resources development, *Hydrogeology, Water wells, Water utilization, Groundwater recharge, Water conservation, Bore holes, Dug wells, Water management(Applied), Water table.

Results of geohydrological investigations conducted in the semi-arid areas of Coimbatore District, Tamil Nadu, India during 1974-75 to determine groundwater conditions are reported. Analysis of more than 150 bore wells classified according to yield indicate that more than 70% of the groundwater yield is tapped within 50 meters of the surface and it is accordingly uneconomical to drill deeper than this depth. In addition to the bore wells, a large number of dugwells and dug-cum wells which are utilized in this area during low rainfall years are being deepened every year by 1 to 2 meters, lowering the water table to 20-30 meters below ground level. Based upon these results it is suggested that a program should be developed to: (1) artificially recharge groundwater reserves, (2) develop the existing dug wells with horizontal bores, (3) practice effective conservation and management methods, and (4) rock shoot to develop artificial fractures and fissures. (Tickes-Arizona)
W79-08029

TRANSIENT RESERVOIR-AQUIFER INTERACTION,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W79-08100

STORAGE COEFFICIENTS FROM AQUIFER MAPS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Civil Engineering.
B. M. Sahni, and H. S. Seth.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings Paper 14658, p 205-212, June 1979. 4 fig, 6 ref, 2 append.

Descriptors: *Aquifer characteristics, *Storage coefficient, *Groundwater, Observation wells, Potentiometric level, Maps, Water levels, Artesian heads, Aquifer testing, Wells, Hydrology, Groundwater resources, Foreign countries, Foreign research, *India, *Pantnagar(India), *Piezometric contour maps, Finite difference equations.

A method for determining the storage coefficient of an aquifer using piezometric contour maps was presented. The method is based on the transient groundwater flow equation simplified and reduced to finite difference form. Since drilling of observation wells is expensive and time consuming, this procedure is particularly useful for preliminary assessment of groundwater resources of an area where no observation wells near the abstraction wells are available. The values of the aquifer storage coefficient in the Pantnagar University Farm area obtained by this method showed good agreement with those obtained by means of pumping tests. (Visocky-ISWS)
W79-08104

ROLE OF UNDERGROUND COMPONENTS IN THE HYDROLOGIC BUDGET OF LAKES AND RESERVOIRS,
Z. A. Vikulina.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 200-207, 1977. 3 fig, 4 tab, 24 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 240, p 96-112, 1977.

Descriptors: *Groundwater, *Base flow, *Lakes, *Reservoirs, *Hydrologic budget, Inflow, Discharge(Water), Rivers, Storage, Water storage, Hydrogeology, *USSR.

The underground components of the hydrologic budget of inland bodies of water were subdivided according to their participation in the total supply and loss of water, into: (1) groundwater inflow; (2) groundwater outflow; and (3) change in bank storage. The first is the incoming, the second the outgoing, and the third the 'accumulative' component of the hydrologic budget. The most common among underground components of the hydrologic budget of lakes and reservoirs is groundwater inflow. The proportion of groundwater in the total water supply to lakes and reservoirs differs: in large lakes and reservoirs with basins in the lowland regions of the excessively wet zone, groundwater inflow is insignificant and does not exceed several per cent of the total supply. The groundwater inflow to many large mountain, piedmont, and steppe lakes is commensurate with surface inflow, while it is one of the main gain components of the budget of small lakes in arid regions. Groundwater inflow is significant in the hydrologic budget of bog lakes and, under otherwise equal conditions, its share is greater in lakes with a relatively large drainage area. Groundwater inflow can also be considerable in deeply-entrenched small lakes in the excessively wet zone, the small tributaries of which do not drain the entire thickness of the aquifers. (Sims-ISWS)
W79-08105

DETERMINATION OF THE INITIAL 14C ACTIVITY OF THE TOTAL DISSOLVED CARBON: A REVIEW OF THE EXISTING MODELS AND A NEW APPROACH,
Paris-6 Univ. (France). Lab. de Geologie Dynamique.
J-C. Fontes, and J-M. Garnier.
Water Resources Research, Vol. 15, No. 2, p 399-413, April 1979. 5 fig, 6 tab, 44 ref.

Descriptors: *Carbon radioisotopes, *Groundwater, *Model studies, *Mathematical models, Reviews, Radioactive dating, Carbon, Isotope studies, Dissolved solids, Carbon dioxide, Carbonates, Chemistry, Water chemistry, Geochemistry, Hydrology, Carbon dating, Hydrochemistry.

Carbon 14 age calculations are based upon the assumption that the initial activity of the material to be dated was 100% of modern CO2 activity (100 pmc). This assumption is generally good for material of organic origin (wood and, to some extent, shells). Dissolved carbon in groundwater has two main sources; active carbon from the soil zone and less active (or even 'dead') carbon of inorganic origin. Furthermore, the existence of a three-phase system (gaseous CO2 and aqueous and solid carbon) allows significant isotopic exchange. The estimation of the initial activity of the total dissolved carbon requires the use of a model. Existing models for the determination of the initial 14C activity (A sub o) of total dissolved carbon are (1) Vogel's model (A sub o = 85 + or - 5% of modern carbon), (2) Tamers' model (A sub o is the activity of dissolved carbon of organic origin diluted by dissolved carbon of inorganic origin), (3) Pearson's model (A sub o is the mixing of these same sources of carbon, evidenced by their stable isotope content), and (4) Mook's model (same as Tamers' model plus a correcting term accounting for an isotopic exchange in closed system with aqueous CO2). A new model was presented which assumes the simple mixing of the end-members of the system (gaseous CO2 and solid carbonate). (Sims-ISWS)
W79-08106

CHARACTERISTICS OF THE INTERACTION BETWEEN RIVER AND GROUND WATERS IN MOUNTAIN REGIONS,
A. Z. Amus'ya.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 193-199, 1977. 2 fig, 11 ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No. 240, p 73-85, 1977.

Descriptors: *Groundwater, *Mountains, *Rivers, *Geomorphology, Classification, Streams, Karst, Regions, Topography, Hydrogeology, Recharge, Aquifers, Natural recharge, Springs, Foreign research, Foreign countries, Water sources, *Piedmont plains.

In the absence of quantitative characteristics of the hydrodynamic interaction of river water with groundwaters in mountain regions, one must use indirect characteristics, derived from an analysis of various physiographic information, to describe this interaction. This paper described the main characteristics of this interaction under various geomorphological conditions in mountain regions with reference to groundwater inflow. Account was taken of the character of the relief, its degree of dissection, and other physiographic characteristics, including hydrogeological conditions, the description of which is supplemented by an analysis of data on the groundwater regime. Geomorphological zones discussed included: (1) high-mountain, deeply dissected (alpine) relief; (2) medium-mountain relief (peripheral parts of high mountains and individual mountain systems, uplands in folded mountain regions); (3) suppressed volcanic relief; (4) weakly (and moderately) dissected high-mountain relief; (5) foothills; and (6) piedmont plains. The descriptions of the conditions of formation of groundwater inflow gave the most general qualitative idea of the characteristics of interaction of river with groundwaters in the most typical kinds of relief of mountain countries. Various local forms of relief develop depending on the stability of rocks on slopes and water-divide ridges and also in the valleys of mountain rivers. In determining groundwater inflow into specific rivers, allowance should be made for the characteristics of dissection of microrelief forms in the investigated drainage basin, which forms affect the general features of the hydrodynamic interaction between river and groundwaters. (Humphreys-ISWS)
W79-08211

SEEPAGE STREAMS OUT OF CANALS AND DITCHES OVERLYING SHALLOW WATER TABLES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
J. C. Bruch, Jr.
Journal of Hydrology, Vol. 41, No. 1/2, p 31-41, April 1979. 2 fig, 1 tab, 8 ref.

Descriptors: *Seepage, *Canal design, *Water table, Ditches, Drainage, Groundwater, Hydrology, Porous media, Shallow water, Streams, Mathematical studies, *Shallow water table, Water logging, Baiocchi method, Seepage streams.

When there is seepage from a canal or ditch overlying a shallow water table, waterlogging of the

soil at distant points is a distinct possibility. Thus, for given flowfield parameters, it is desirable to be able to predict the limit of the drainage capacity whic can be handled without producing this condition of waterlogging at distant points. A simple numerical scheme was presented for the solution of such problems. This numerical scheme, based upon the Baiocchi method and transformaton, gives a quick, simple, and accurate means of obtaining the discharge and the free-surface location knowing the physical parameters of the particular canal or ditch problem. Thus, the data necessary to investigate the waterlogging phenomenon for a particular flow situaton can readily be obtained from the application of this numerical approach. The numerical results obtained for specific applications were compared with other published results to similar problems. Also, a discussion was presented concerning the numerical results and the performance of the numerical scheme. (Lee-ISWS)
W79-08250

THE RANGE OF WATER TEMPERATURE FLUCTUATIONS IN THE LIMESTONE WATERS OF THE CENTRAL AND SOUTHERN PENNINES,
A. F. Pitty, R. A. Halliwell, J. L. Ternan, P. A. Whittel, and R. G. Cooper.
Journal of Hydrology, Vol. 41, No. 1/2, p 157-160, April 1979. 1 fig, 10 ref.

Descriptors: *Groundwater, *Springs, *Water temperature, *Fluctuations, Variability, On-site investigations, On-site data collections, Caves, Subsurface waters, Underground streams, Temperature, Air temperature, Hydrogeology, *England.

As part of geomorphological research into fluvial processes, seasonal fluctuations in several variables have been measured for a large number of streams and risings in the limestone areas of northern England. Apart from a preliminary, general coverage of 37 sites in NW Yorkshire which were visited 12-16 times, and the North York Moor sites which were visited on 18 or more occasions, most of the remaining sites were visited on at least 24 occasions over a one- or two-year period. In most cases, water temperatures estimated to 0.01C were taken as close as practicable to the point of emergence. As very slight modification of the water temperature by air temperature close to the emergence point remains an inevitable possibility, in addition to other possible sources of operator and instrument variance and the effect of time of day when sampling occurred, the standard deviations were reported as upper limits of the true variability of underground water. The data was presented in two histograms. Of the risings, the modal class is that of the narrowest temperature range, with standard deviations of less than 0.20C. Groundwaters once incorporated in to surface flow temperature fluctuations is 3.40-3.59C. Significantly, virtually all risings fall on the narrower side of this mode. Thus, some groundwater component in surface flows with temperature ranges narrower than s.d. = 3.40C may be postulated. (Sims-ISWS)
W79-08253

INERT GASES IN GROUNDWATER FROM THE BUNTER SANDSTONE OF ENGLAND AS INDICATORS OF AGE AND PALAEOCLIMATIC TRENDS,
Bath Univ. (England). School of Chemistry.
J. N. Andrews, and D. J. Lee.
Journal of Hydrology, Vol. 41, No. 3/4, p 233-252, May 1979. 6 fig, 4 tab, 28 ref.

Descriptors: *Groundwater, *Gases, *Paleoclimatology, *Isotope studies, Radioactive dating, Radioisotopes, Radium radioisotopes, Uranium radioisotopes, Helium, Sandstones, Aquifers, Recharge, Hydrology, Paleohydrology, Climatology, *England, *Nottinghamshire(England), Inert gases, Thorium.

A study of the radiogenic and atmospherically derived inert gases in groundwaters from the Bunter Sandstone aquifer of Nottinghamshire, England, was described. The radiogenic gases, 222Rn and 4He, were derived by decay of the radioelements contained in the aquifer. The relationship between radioelement content of the rock and groundwater 222Rn and 4He contents was discussed. An increase in the dissolved 4He content with groundwater age was demonstrated and correlated with 14C ages. Excess 4He ages calculated from average physical properties and radioelement contents of the aquifer rock were greater than the corrected 14C ages, and possible explanations for this were discussed. The dissolved Ar and Kr contents of the groundwaters indicated their temperature of air equilibration in the unsaturated zone at recharge. The recharge temperatures for groundwaters of age greater than 20,000 yr. are 5-7C lower than those for waters recharged in the last 10,000 yr. This was shown to be consistent with the palaeoclimatic record for England during the late Pleistocene. (Sims-ISWS)
W79-08254

PREDICTION OF NON-DARCY FLOW IN POROUS MEDIA,
British Columbia Univ., Vancouver.
J. de Vries.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings Paper 14610, p 147-162, June 1979. 7 fig, 1 tab, 19 ref, 2 append.

Descriptors: *Darcys law, *Groundwater, *Porous media, Permeability, Model studies, Equations, Flow, Groundwater movement, Viscous flow, Reynolds number, Efficiencies, Permeameters, Instrumentation, Hydraulic gradient, *Non-Darcy flow, Inertial forces, Glass beads.

Equations were derived that facilitate prediction of both the onset of non-Darcy flow in a porous medium and the viscous and inertia force fractions of the hydraulic gradient dp/ds after non-Darcy flow has begun. The equations are based on measurements of hydraulic gradients, dp/ds, and corresponding fluxes, q, carried out with a permeameter in both the Darcy and non-Darcy flow regions on 0.8-mm to 1.4-mm and 0.4-mm to 0.6-mm glass beads and sand. Hydraulic resistivities, r, were calculated from dp/ds and q. The value of r(q) was found to be linear in the non-Darcy region. This linearity was used to determine the value of a non-Darcy flow parameter, e. Its value was found to be 0.7 for glass beads and 0.9 for sand. At the onset of non-Darcy flow, 94.7% and 5.3% of dp/ds were used in viscour and inertia force flow, respectively. Calculations require knowledge of both the intrinsic permeability and e for the porous stratum under consideration. A value of e = 0.9 was suggested for materials found in the field. (Visocky-ISWS)
W79-08263

ARTIFICIAL GROUNDWATER RECHARGE AND ITS RELEVANCE IN BRITAIN,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 4B.
W79-08266

ZONALITY OF GROUND-WATER RUNOFF UNDER HUMID CONDITIONS,
V. N. Ostrovskiy.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 184-192, 1977. 5 fig, 1 tab, 39 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 240, p 32-50, 1977.

Descriptors: *Groundwater recharge, *Base flow, *Humid areas, *Europe, Soils, Soil water, Groundwater, Infiltration, Evaporation, Permeability, Precipitation(Atmospheric), Rivers, Runoff, Mapping, *USSR.

In humid lowland regions, the areal zonality of groundwater recharge through infiltration in the zone of active water exchange, the evaporation of groundwaters, and their runoff depend mainly on landscape-climatic factors. A quantitative relation has been established between the coefficients of zonal groundwater runoff and the atmospheric moisture deficit in the European USSR. The magnitude of the zonal groundwater runoff in humid lowland regions is determined also by net radiation, the aridity index, and precipitation. The structure of an equation relating groundwater runoff with these meteorological elements for the European USSR has been identified. In lowland regions, azonal factors (geology and relief) are superposed on the latitudinal zonality of groundwater runoff, but they do not change it significantly. (Sims-ISWS)
W79-08284

HYDROGEOLOGIC FACTORS AFFECTING THE AVAILABILITY AND QUALITY OF GROUND WATER IN THE TEMPLE TERRACE AREA, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. W. Stewart, C. L. Goetz, and L. R. Mills.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 841, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-4, 1978. 38 p, 11 fig, 4 tab, 7 ref.

Descriptors: *Groundwater availability, *Aquifer characteristics, *Water quality, Water yield, Hydrogeology, Groundwater movement, Surface-groundwater relationships, Water supply, Florida, *Temple Terrace area, Hillsborough County.

Ground water occurs in two aquifers in the Temple Terrace area of Hillsborough County, Fla. The lower one is the artesian Floridan aquifer; the upper is the water-table aquifer. The Floridan aquifer is a thick sequence of limestone and dolomite layers which include several permeable zones that generally are treated as a single hydrologic unit. The top of the Tampa Limestone is considered to be the top of the Floridan in the Temple Terrace area. The public supply wells of the city tap the Tampa Limestone and the underlying Suwannee Limestone, in the upper part of the Floridan. The general direction of ground-water movement in the Floridan aquifer is from north to south, but within the city the direction of movement is from northeast to southwest. The quantity of water moving southwest through a 1.8 mile section of the aquifer is about 2.7 million gallons per day. Ample supplies of water in a cavernous limestone, considered to be the most productive water-yielding zone in the aquifer, are available for additional development from the Floridan aquifer. Water-quality data are included also. (Woodard-USGS)
W79-08385

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE GREYBULL RIVER VALLEY, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08391

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-08394

WATER RESOURCES OF THE NORTHERN UINTA BASIN AREA, UTAH AND COLORADO, WITH SPECIAL EMPHASIS ON GROUND-WATER SUPPLY,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08395

WATER IN THE DAKOTA FORMATION, HODGEMAN AND NORTHERN FORD COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4D.
W79-08396

THE OLIGOCENE AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08399

2G. Water In Soils

EFFECT OF DIFFERENT-ELECTROLYTE LEACHING WATERS ON HYDRAULIC CONDUCTIVITY AND E.S.P. OF IDKU SOILS, A.R.E.,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
H. M. A. Bakr, A. M. Fathy, and S. E. A. Awadallah.
Alexandria Journal of Agricultural Research, Vol. 26, No. 2, p 481-487, 1978. 5 tab, 11 ref.

Descriptors: *Hydraulic conductivity, *Leaching, *Saline water, *Ion transport, *Cation exchange, Soil chemical properties, Soil physical properties, *Electrolytes, Irrigation effects, Permeameters, Water properties, Electrochemistry, Salts, Sodium compounds, Alkalinity, Egypt.

Tests were conducted on soil samples from the Mediterranean coastal desert area northeast of Alexandria, Egypt, to determine effects of different electrolyte leaching waters on soil hydraulic conductivity and exchangeable sodium percentages (ESP). To verify the importance of salt concentrations of leaching water on the chemical and physical properties of soils for productive use, experiments were set up to simulate soils of differing alkalinities, with each set of samples subjected to 1 or 4 leaching treatments of variable electrolyte concentrations. Results indicated that the transmission rate of water through alkali soils depends upon the electrolyte concentration of the leaching water, with reductions in hydraulic conductivity being more pronounced when leaching with water containing monovalent cations than those with divalent. It is concluded that soils having high exchangeable sodium percentages can be reclaimed by leaching with successive dilutions of highly saline water. (Tickes-Arizona)
W79-08013

RELATIONS BETWEEN SOME PHYSICAL AND CHEMICAL FACTORS AFFECTING HYDRAULIC CONDUCTIVITY OF EDKO SOILS, A.R.E.,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
A. M. Fathy, H. M. A. Bakr, and S. A. Awadallah.
Alexandria Journal of Agricultural Research, Vol. 26, No. 2, p 467-472, 1978, 3 tab, 17 ref.

Descriptors: *Cation exchange, *Soil physical properties, *Soil chemical properties, *Hydraulic conductivity, Chemical reactions, Egypt, Clay minerals, Cation adsorption, Chemical properties, Soil analysis, Electrical conductance, Soil structure, Correlation analysis, Regression analysis.

Various cations appearing either on the soil complex as exchangable cations or in the soil solution as soluble cations, play an important role in determining the physical and chemical soil properties which affect hydraulic conductivity. For the purpose of the present study, five undisturbed soil samples were collected from four different profiles and locations according to their color or texture to determine the relationship between hydraulic conductivity and (1) electrical conductivity, (2) structure factor, (3) large pores percentages and (4) dispersion ratio. Results indicated a positive linear relationship between large pore percentage and exchangable calcium percentage and a negative linear relationship between large pore percentage and exchangable sodium percentage. These results reflect the stability of clay aggregates with an increase in the structure factor. Accordingly, the relationship between hydraulic conductivity and the structure factor was found to be positive and linear while the dispersion ratio was negative and linear. The effect of undispersed clay on decreasing hydraulic conductivity was lower than that of dispersed clay although both were found to be in a negative and linear relationship with hydraulic conductivity. (Tickes-Arizona)
W79-08016

SOIL MOISTURE: A MULTIDISCIPLINARY PROBLEM,
Central Road Research Inst., New Delhi. Soil Mechanics Div.
P. Jagannatha Rao.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 185-189, Dec 1977. 6 ref.

Descriptors: *Soil moisture, *Soil-water-plant relationships, *Soil physical properties, *Soil water movement, Soil water, Soil physics, Theoretical analysis, Rainfall disposition, Environmental effects, Thermal properties, Saline soils.

Although it frequently appears in arid regions that soil moisture changes are unlikely to take place in quantities that are of significance to engineering activities, numerous case histories, field studies and experimental investigations have proven otherwise and aroused the interest of civil engineers. Some of theoretical methods available for solving the problems of soil moisture in relation to civil engineering and their limitations are discussed in this paper. The problems analysed include: (1) the determination of water table, rainfall, temperature and other environmental conditions in relation to soil type and moisture movement, (2) how to predict the rate and quantity of moisture movement under various boundary conditions and in different types of soils, and (3) how to predict the amount of volume change associated with above moisture movement. Of vital significance in solving these problems are the determination of the amount of water in the soil, the movement of this water in response to various osmotic, electrical and thermal gradients, and the associated movement of salts, heat and electricity. (Tickes-Arizona)
W79-08030

MASS TRANSFER IN POROUS MEDIA WITH IMMOBILE WATER,
Vrije Univ., Brussels, (Belgium).
F. De Smedt, and P. J. Wierenga.
Journal of Hydrology, Vol. 41, No. 1/2, p 59-67, April 1979. 5 fig, 17 ref.

Descriptors: *Mass transfer, *Boundary processes, *Porous media, *Mathematical models, Solutes, Leaching, Dispersion, Convection, Theoretical analysis, Equations, Convolution integral, Immobile water fraction.

An analytical solution was presented for the movement of a solute through a porous medium, which is leached at a constant rate. The solution takes into account diffusion into an immobile water fraction. The generalized solution is valid for both finite or semi-infinite media and for concentration or flux-type boundary conditions. The solution consists of a convolution integral of two functions. The first function is the derivative vs. time of the corresponding solutions of the solute transfer equation without lateral diffusion. The second function is the J-function, for which a series approximation was developed. The use of the solution was illustrated with displacement studies in a 30 cm long column, filled with glass beads. It was shown that effluent concentration distributions from, and solute concentration distributions inside the column, when unsaturated, cannot be explained without taking into account an immobile water fraction. (Visocky-ISWS)
W79-08101

AN ITERATIVE METHOD FOR CALIBRATING A MULTICELL AQUIFER MODEL,
Hydrological Service of Israel, Jerusalem.
Y. Bachmat, and A. Dax.
Water Resources Research, Vol. 15, No. 2, p 305-312, April 1979. 10 fig, 2 tab, 5 ref.

Descriptors: *Model studies, *Aquifers, *Algorithms, *Least squares method, *Aquifer characteristics, Water levels, Rainfall, Storage coefficient, Transmissivity, Mathematical models, Equations, *Inverse problem, *Multicell models, Aquifer models, Israel, Iterative method, Quadratic programming, Objective function.

The inverse problem was formulated as a linear least squares problem. Lower and upper bounds on the parameters were added to ensure hydrologic plausibility. The proposed algorithm utilized the special structure of the problem to enable efficient handling of models which are composed of a large number of cells. An example of calibrating a 241-cell model of the coastal aquifer of Israel with the proposed algorithm was presented. (Visocky-ISWS)
W79-08102

ISOTOPE AND ION GEOCHEMISTRY OF GROUNDWATERS IN THE MILK RIVER AQUIFER, ALBERTA,
Alberta Univ., Edmonton. Dept. of Geology.
F. W. Schwartz, and K. Muehlenbachs.
Water Resources Research, Vol. 15, No. 2, p 259-268, April 1979. 8 fig, 1 tab, 27 ref.

Descriptors: *Geochemistry, *Groundwater, *Stable isotopes, *Artesian aquifers, *Canada, Groundwater recharge, Geologic units, Oxygen isotopes, Deuterium, Cation exchange, Spatial distribution, Meteoric water, Mixing, Water chemistry, Outcrops.

The Milk River artesian aquifer underlines an area of approximately 6300 sq km in southern Alberta. Analysis of stable isotope and major ion data for water samples collected from the aquifer revealed a variety of striking patterns. Oxygen-18 and deuterium concentrations for groundwater from the recharging portion of the aquifer fall very close to the meteoric water line, indicating that they are isotopically unaltered meteoric waters. Proceeding down-dip in the aquifer, groundwaters become enriched isotopically to a maximum of 70 and 12 parts per thousand with respect to deuterium and oxygen-18 in the recharging waters. In addition, a systematic deviation (slope of 6.1 instead of 8) from the meteoric water line is also apparent. The most plausible explanation of these isotopic patterns is based on a process of dispersion or mixing on a regional scale. Waters probably enriched with respect to the isotopic composition of the aquifer recharge may be present and simply are being displaced by meteoric water, the aquifer recharge may be present and simply are being displaced by meteoric water, or leakage may have entered the aquifer from below progressively comprising an increased proportion of the aquifer water. This same type of mixing process appears to exert a major control on the major ion chemistry of the aquifer. In addition, chemical processes such as mineral dissolution and cation exchange play a role. (Visocky-ISWS)
W79-08103

AN ELECTRONIC ANALOG FOR UNSATURATED FLOW AND ACCUMULATION OF MOISTURE IN SOILS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
G. P. Wind, and A. N. Mazee.
Journal of Hydrology, Vol. 41, No. 1/2, p 69-83, April 1979. 11 fig, 3 ref.

Descriptors: *Analog models, *Unsaturated flow, *Soil moisture, Soil physical properties, Equations, Electronic equipment, Infiltration, Runoff, Ponding, Moisture content, Drainage, Integrated flow equation, Ohms law, The Netherlands, Layered model.

An electronic analog model of the unsaturated zone has been developed, based on the similarity between the integrated flow equation and Ohm's law. The main difference between the two equations is compensated for by amplifiers. The model simulates one day in 2 s. There are 10 normal layers, each with adjustable magnitude. Moreover, there is a top layer in which infiltration, ponding, and runoff are simulated, and a drain layer with adjustable drain intensity. The normal layers contain an adjustable resistor for the connection with

another layer and a function generator for the k (theta) relation. There are two transition layers which have to be placed at the boundary between two laycrs of different soil properties. Under saturated conditions, the model is acting incorrectly, so that a too small thickness of the saturated layers is calculated. This can be compensated for by using an equivalent drain intensity which is lower than the real one. The model can be used to simulate the effect of natural rainfall and evaporation on moisture content at every depth. Soil physical properties and drainage conditions can be adjusted. Homogeneous as well as layered soil can be represented by the model. In particular, it can be applied to investigate the drainage requirements of soil. Some examples of the applicability of the model and short technical description were presented. (Visocky-ISWS)
W79-08141

SEEPAGE STREAMS OUT OF CANALS AND DITCHES OVERLYING SHALLOW WATER TABLES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W79-08250

THE DESIGN OF A PORTABLE RAINFALL SIMULATOR INFILTROMETER,
Dundee Univ. (Scotland). Dept. of Geography.
A. S. Tricker.
Journal of Hydrology, Vol. 41, No. 1/2, p 143-147, April 1979. 3 fig, 6 ref.

Descriptors: *Infiltrometers, *Rainfall simulators, *Equipment, Rainfall, Simulated rainfall, Infiltration, Infiltration rates, Runoff, Design, On-site investigations, On-site collections, Soil physics, Soil properties, Soil science.

The construction of a hand-portable rainfall simulator infiltrometer was described. The rainfall simulator infiltrometer described can be carried, set up, and operated conveniently by one man and offers a fast, economical means of measuring infiltration capacity. It requires only 1.5-2 man hours per measurement, and thus 3-4 measurements may be accomplished in a day. (Sims-ISWS)
W79-08252

PORE DISTRIBUTION AND PERMEABILITY OF SILTY CLAYS,
CH2M Portland, OR.
I. Garcia-Bengochea, C. W. Lovell, and A. G. Altschaeffl.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 105, No. GT7, Proceedings Paper 14686, p 839-856, July 1979. 7 fig, 2 tab, 39 ref, 2 append.

Descriptors: *Permeability, *Pores, *Clays, Porous media, Fabrics, Soil water, Soil water movement, On-site investigations, Laboratory tests, Mercury, Data processing, Soils, Model studies, Mathematical models, Soil science, Pore size distribution.

This investigation utilized pore size distribution measurements to examine the relationship between permeability and compactive variables for laboratory compacted clayey silts. Closed-system falling head permeability tests under back pressure were performed on each of the compacted samples. Freeze drying was successfully used to dehydrate specimens prior to pore size measurements. The mercury intrusion technique was used to determine the pore size distribution. The pore size distributions of the soils tested were biomodal, with a large pore mode occurring between 10 micrometers and 1 micrometer and a small pore mode occurring at 0.1 micrometer. Varying the compaction variables produced changes in the size and frequency of the large pore mode, but caused no change in the pore size distribution about the small pore mode for a given soil type. Three theoretical permeability models that relate pore size distribution parameters to permeability were generated. These parameters were successfully used to determine empirical permeability prediction equations for the soils tested. (Sims-ISWS)
W79-08264

INVESTIGATION OF VERTICAL MOISTURE TRANSPORT IN THE UPPER LAYERS OF UNDRAINED HIGHMOOR BOGS BY MEANS OF RADIOACTIVE ISOTOPES,
V. I. Surovov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 179-183, 1977. 3 fig, 4 tab, 8 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 236, p 57-65, 1977.

Descriptors: *Soil water movement, *Bogs, *Isotope studies, Moisture content, Soils, Soil water, Water transfer, Infiltration, Capillary water, Capillary conductivity, Hydraulic conductivity, Peat, Organic matter, Organic soils, *USSR.

Vertical moisture transport was investigated by means of radioactive isotopes using trivalent iron chelate, Fe59, as a label for water in May-August 1968. Two monoliths measuring 20 x 20 x 50 cm were taken from a thinly pine-wooded sphagnum-subshrub-cotton grass microlandscape and from a sphagnum-subshrub-pine microlandscape of Lammin-Suo bog for experiments on the movement of water in the upper layers of the peat deposit during evaporation. The peat deposit consisted mainly of 5% decomposed fuscum peat. The method developed for investigating the vertical movement of water and the volumetric radio-indicator method made it possible to determine several characteristics (the layer-by-layer rate of water flow and discharge, the amount of water retained in a layer) describing the vertical moisture transport. The dependence of the rate of transport of labeled water on time was determined by means of the characteristics obtained. It was shown that the zone of water evaporation in the active layer can be determined. From the experimental data, it follows that water evaporates from the capillaries of the upper boundary of the capillary zone in a thinly pine-wooded sphagnum-subshrub-cotton grass landscape and that water is removed from the leaves of the upper-most layer during evaporation and the evaporation zone recedes into the next layer in a sphagnum-subshrub-pine microlandscape. (Sims-ISWS)
W79-08278

ZONALITY OF GROUND-WATER RUNOFF UNDER HUMID CONDITIONS,
For primary bibliographic entry see Field 2F.
W79-08284

RELATIONS BETWEEN AVAILABLE WATER STORAGE CAPACITY AND PERCENTAGE CONTENTS OF SAND, SILT, CLAY AND CACO IN SOME CALCAREOUS SANDY SOILS AT NORTHWESTERN LIMIT OF NILE DELTA,
Alexandria Univ. (Egypt). Dept. of Soils and Water.
H. M. A. Bakr.
Alexandria Journal of Agricultural Research, Vol. 26, No. 2, p 473-480, 1978, 2 tab, 14 ref.

Descriptors: *Soil water, *Soil moisture, *Sands, *Silts, *Clays, *Calcium carbonate, *Calcareous soils, Sampling, Field capacity, Wilting point, Correlation analysis, Regression analysis, Soil texture, Soil profiles, Nile Delta.

Although much information is presently available concerning the conventional moisture contents of Egyptian calcareous soils, a complete study of the factors affecting this variable has yet to be carried out. Accordingly, this author reports here his quantitative assessment of the effects of the percentage contents of sand, silt, clay and calcium carbonate on the available water storage capacity in 84 sandy calcareous soils collected from the northwestern limit of the Nile Delta. Samples taken from 16 profile pits opened in the West Noubaria and North Tahrir areas were crushed, composited for each soil layer, and passed through a 2 mm sieve. Available moisture storage, calcium carbonate content and mechanical composition for all soil samples were determined and subjected to statistical analysis. Results indicated a positive correlation between available water capacity and percentage content of silt, clay and calcium carbonate and a negative correlation with sand. Relationships between clay sand and percentage moisture content at field capacity and permanent wilting point were indicated from highly significant correlation coefficients and it is suggested that calcium helps improve the storage capacity in coarse textured soils by the formation of silt-sized micro aggregates. (Tickes-Arizona)
W79-08292

GROUNDWATER SOURCES LOCATED BY FRACTURE TRACE TECHNIQUE,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. F. Sharpe, and R. P. Parizd.
Water and Sewage Works, Vol. 126, No. 5, p 38-40, May 1979. 3 fig, 2 tab, 5 ref. OWRT A-005-PA(9). 14-34-001-8040.

Descriptors: *Groundwater, *Exploration, *Hydrogeology, Fractures(Geologic), Mapping, Surveys, Locating, Terrain analysis, Groundwater resources, Aquifers, Remote sensing, Aerial photography, Cracks.

By studying black and white or color aerial photographs, hydrogeologists can determine the location of fracture traces by looking at the surface alignment of sags and depressions, soil tonal differences in plowed fields, and differences in vegetation patterns. These land features, difficult to distinguish on the ground, can be seen rather easily from the air. A skilled individual can map 100 acres of land in a few minutes. These fractures, or cracks, are clustered in zones ranging 5 to 50 feet wide and several thousand feet to more than a mile in length. Each fracture zone may contain from 1 to 200 separate fractures or cracks, with 5 or 10 fractures or zones of fracture in any 100 acre area. Once the fractures are mapped on the aerial photograph, the hydrogeologist takes it into the field to determine where the fractures are located on the ground. The precise location of a fracture intersection is determined from ground reference points identified on the photographs and is marked appropriately for the well driller. By drilling precisely on this intersection point, the chances of obtaining a good supply of water are greatly increased. Aerial photographs suitable for fracture-trace mapping are available for the entire U.S. Normally, they can be borrowed from the Agricultural Stabilization and Conservation Service or the Soil Conservation Service office located in almost every county. (Humphreys-ISWS)
W79-08338

INTERRELATIONS OF THE PHYSICAL PROPERTIES OF COPPICE DUNE AND VESICULAR DUNE INTERSPACE SOILS WITH GRASS SEEDLING EMERGENCE,
Texas A and M Univ., College Station. Dept. of Range Science; and Max C. Fleischmann Coll. of Agriculture, Reno NV. Renewable Natural Resources Div.
M. K. Wood, W. H. Blackburn, R. E. Eckert, and F. F. Peterson.
Journal of Range Management, Vol. 31, No. 3, p 189-192, May 1978, 4 tab, 3 fig, 13 ref.

Descriptors: *Seeds, *Dunes, *Aeolian soils, *Mositure stress, *Soil physical properties, *Crop response, *Vegetation establishment, Infiltration rates, Sedimentation, Organic matter, Soil-water-plant relationships, Soil water movement, Hydrologic properties, Soil mechanics.

Characterized by high silt content, low organic matter, and poor aggregation, surficial vesticular horizons have been found to be a major contributing factor to low infiltration rates, sediment production, and sparse vegetation in many arid and semiarid rangelands throughout the world. Soil samples from the Coils Creek Watershed in Nevada were analyzed to characterize some of the physical attributes of coppice dune interspace soils, and to determine the influence of organic matter removal in vesicular development and the effect of a vesicular horizon on seedling emergence. Results indicated that seedling emergence of crested wheatgrass (Agropyron desertorum) and squirrel

tail (Sitanion hytrix) was poor and seedling stress high in vesicular dune interspace soil while the removal of organic matter from coppice dune soils resulted in a poorly aggregated vesicular soil with similar properties as those of untreated interspace soils. (Tickes-Arizona)
W79-08348

NITROGEN POOLS AND FLUXES IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
E. Haines, A. Chalmers, R. Hanson, and B. Sherr.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 241-254. 3 fig, 2 tab, 42 ref.

Descriptors: *Nitrogen, *Salt marshes, *Georgia, *Soils, Marshes, Wetlands, Rooted aquatic plants, Vegetation, Seasonal, Roots, Denitrification.

Preliminary data on standing stocks of nitrogen and on rates of nitrogen fixation and denitrification in Spartina alterniflora salt marshes on the Georgia coast have yielded a general concept of the nitrogen cycle in this system. The Georgia salt marsh is characterized by fine-textured clay soils, a tidal amplitude of two meters, and high rates of primary production throughout the year. Most combined nitrogen in the system is in the soils in forms not readily available to primary producers. The amounts of exchangeable ammonium, nitrate, and nitrite are small and change seasonally. The presence of nitrate and nitrite in the soil implies that nitrification occurs in the aerobic microzones around Spartina roots. The annual input to the marsh via nitrogen fixation and other quantified sources of nitrogen is as large as the seasonal accumulation of nitrogen by Spartina growth; the input is balanced by the loss of nitrogen via denitrification. The nitrogen input to the marsh is, however, smaller than the estimated nitrogen flux through the marsh plants. Thus, mineral regeneration must satisfy a large part of the nitrogen requirements of Spartina and benthic algae in the Georgia salt marsh. (Stihler-Mass)
W79-08477

2H. Lakes

TRANSIENT RESERVOIR-AQUIFER INTERACTION,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
A. D. Koussis.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14630, p 637-645, June 1979. 3 fig, 6 ref, 1 append.

Descriptors: *Reservoirs, *Aquifers, *Groundwater, *Model studies, Mathematical models, Numerical analysis, Analytical techniques, Equations, Groundwater movement, Permeability, Profiles, Porous media, Drawdown, Flow, Hydrology.

The moving boundary problem of the interaction of a reservoir-aquifer system was studied. The nonlinear partial differential equation (PDE) of Boussinesq was used to describe the transient flow conditions in the semi-infinite, unconfined aquifer. The method of solution involved discretization of only the time derivative to obtain an ordinary differential equation (ODE) in space. The resulting ODE was integrated analytically once, and the remaining initial value problem was solved numerically. The solution developed was of the similarity type. The cases of sudden drawdown and buildup were considered, and computed dimensionless profiles vs. dimensionless similarity parameter were compared with experimental data, exact-analytical, linear-analytical, and numerical solutions for different boundary values. Also, analytical relationships for the exchange flows and flow volumes were derived. (Sims-ISWS)
W79-08100

ROLE OF UNDERGROUND COMPONENTS IN THE HYDROLOGIC BUDGET OF LAKES AND RESERVOIRS,
For primary bibliographic entry see Field 2F.
W79-08105

IRRIGATION RESERVOIR THAT SILTS UP INSIGNIFICANTLY,
G. A. Urlapov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 256-258, 1977. 2 fig, 1 tab, 8 ref. Translated from Gidrotekhnika i Melioratsiya, No. 6, p 34-38, 1977.

Descriptors: *Reservoirs, *Sediments, *Irrigation, *Design, Dams, Embankments, Reservoir silting, Flood plains, Rivers, Lakes, Irrigation water, Storage, Water storage, Sedimentation rates, Sedimentation.

The service life and efficiency of reservoirs depend largely on their rate and character of silting, which is affected not only by the hydrologic regime of the river and operating conditions of the reservoir, but also by its design. When constructing reservoirs for irrigation, there is no need to pass the entire runoff through them. It is sufficient to store the excess runoff with respect to the volume of water consumed in the lower pool. In this case, it is also inadvisable to pass the excess flood and transient runoff through the filled reservoir. The proposed design of a valley-type reservoir consists of two parts: channel and floodplain. River water first enters the channel part of the reservoir, where it clarifies because of the settling of part of the suspended load, and then the floodplain part enters through a lateral spillway at the floodplain edge of the river channel. The sill of this spillway rises above the bottom of the channel so that it prevents bottom sediments from entering the floodplain part of the reservoir and reduces the amount of suspended sediments that enter it. (Sims-ISWS)
W79-08142

SOME PROBLEMS OF THE METHOD OF MEASUREMENT OF HYDROCHEMICAL ELEMENTS BY AUTOMATIC STATIONS,
For primary bibliographic entry see Field 5B.
W79-08146

LONG-RANGE FORECAST OF THE STRENGTH OF THE MELTING ICE COVER IN THE VOLGOGRAD RESERVOIR IN SPRING,
For primary bibliographic entry see Field 2C.
W79-08151

SETTLING BEHAVIOR OF NATURAL AQUATIC PARTICULATES,
Chicago Univ., IL. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 2J.
W79-08238

THE 210PB CHRONOLOGY OF A CORE FROM MIRROR LAKE, NEW HAMPSHIRE,
Yale Univ., New Haven, CT. Dept. of Geology and Physics.
For primary bibliographic entry see Field 2J.
W79-08239

THE SPATIAL VARIABILITY OF COASTAL SURFACE WATER TEMPERATURE DURING UPWELLING,
Wisconsin Univ.-Madison. Marine Studies Center.
F. L. Scarpace, and T. Green, III.
Journal of Physical Oceanography, Vol. 9, No. 3, p 638-643, May 1979. 9 fig, 12 ref. NSF 33140.

Descriptors: *Lakes, *Lake Superior, *Great Lakes, *Water temperature, *Upwelling, Winds, Coasts, Shores, Variability, Spatial distribution, Distribution patterns, On-site investigations, Remote sensing, Water circulation, Data processing, Analytical techniques, Limnology.

Thermal scanner imagery acquired during a field experiment designed to study an upwelling event in Lake Superior was investigated. Temperature data were measured by the thermal scanner, with a spatial resolution of 7 m. These data were correlated with temperatures measured from boats. One- and two-dimensional Fourier transforms of the data were calculated, and temperature variances as a function of a wavenumber were plotted. A k to the (-3) power dependence of the temperature variance on wavenumber was found in the wavenumber range of 1 to 25 per km. At wavenumbers more than 25 per km, a k to the (-5/3) power dependence was found. (Sims-ISWS)
W79-08256

ENRICHMENTS OF ZINC, LEAD, AND COPPER IN RECENT SEDIMENTS OF WINDERMERE, ENGLAND,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W79-08257

MODELING ICE REGIME OF LAKE ERIE,
Ecology and Environment, Inc., Buffalo, NY
For primary bibliographic entry see Field 2C.
W79-08262

GENERAL FUNCTIONS AND VALUES OF FRESHWATER WETLANDS IN THE GLACIATED MIDWEST,
Eastern Michigan Univ., Ypsilant. Dept of Geography and Geology.
E. Jaworski, J. R. McDonald, S. McDonald, and C. N. Raphael.
Prepared for Wetlands Science and Technology Workshop, Kellogg Biological Station, Hickory Corners, Michigan, September 12-16, 1977. Protection Agency Sponsored by U.S Army Corps of Engineers and Environmental, 1977. 69 p.

Descriptors: *Freshwater marshes, *Central U.S., *Value, Wetlands, Marshes, Aesthetics, Productivity, Marsh plants, Wildlife habitat, Hydrologic aspects, Geochemistry, Biological properties.

An overview of the functional characteristics and economic values of inland wetlands is presented. Wherever available, key references concerning detailed studies or summarial publications are cited. Discussion focuses on the freshwater wetlands of the glaciated Midwest and includes riverine, lakeshore, and non-surface draining wetlands. Wetland functions covered are biological, hydrological, and biogeochemical. Values discussed include agricultural, commercial fisheries, recreational, and cultural and natural. (Steiner-Mass)
W79-08275

LEGENDS OF A DEAD SEA,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
A. Nissenbaum.
Rehovot, Vol. 8, No. 3, p 30-35, Spring 1978, 4 fig.

Descriptors: *History, *Paleohydrology, *Chemical properties, *Physical properties, *Saline lakes, Geologic history, Buoyancy, Water properties, Sea water, Dead Sea.

The Dead Sea has been a subject of intense mystery and interest throughout recorded history. This unique sea, located on the lowest spot of the earth's surface, is distinguished by its combination of sterile heavy water, sulphurous springs, desolate landscape, and scorching summer heat. These unique physicochemical properties have been aided by man's imagination to form the basis for numerous stories and myths concerning both the sea itself and activities precipitated by its existence. Both historical and geological evidence indicate that this huge evaporation pond, which today contains the highest total dissolved salt content of any permanent body of water, has been hypersaline for at least the past 2000 years. Although there are few Biblical references to this body of water, ancient writers made frequent references to it, portraying it as containing fire, asphalt, and sulfer, and describing it as the cause of the ruin of no less than 13 cities. Equally mysterious are the numerous stories concerning both the sea's unusual buoyancy and the well known account of the transformation of Lot's wife into a pillar of salt. Although such portrayals persisted into the late 19th century, sci-

entific data has largely replaced them, and today this region is characterized by irrigation projects and thriving agricultural settlements. (Tickes-Arizona)
W79-08346

THE EFFECTS OF FIRE ON THE ECOLOGY OF THE BOREAL FOREST, WITH PARTICULAR REFERENCE TO THE CANADIAN NORTH: A REVIEW AND SELECTED BIBLIOGRAPHY,
Canadian Wildlife Service, Delta (British Columbia).
For primary bibliographic entry see Field 4C.
W79-08483

2I. Water In Plants

RESPONSE OF CORN TO LIMITED IRRIGATION ON SANDY SOILS,
Nebraska Univ., North Platte. Dept. of Agricultural Engineering.
G. D. Wilson, D. G. Watts, and P. E. Fischbach.
Paper No. 78-2554, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 11 p. 6 fig, 5 tab, 3 ref, 1 equ, 3 append. ASAE, St. Joseph, Michigan.

Descriptors: Moisture deficit, *Irrigation effects, Growth stages, Plant populations, Yield equations, Corn, Crop production.

The objective was to provide information for producers to enable them to make sound decisions concerning irrigation management when water is limited. Five irrigation management systems were evaluated on a Valentine very fine and (Typic Ustipsamment) in North Central Nebraska in 1977 and 1978. Two management systems included limited irrigation. The latter were subdivided into three treatments each in 1977 providing a total of six discrete limited irrigation treatments. Another treatment was added in 1978 making a total of seven limited irrigation treatments. In each year, the limited irrigation treatments were compared to nonirrigated and fully irrigated checks. Significant water savings were achieved with the limited irrigation treatments. Yield variation from full irrigation yields ranged from 4750 kg/ha reductions to 900 kg/ha increases. As much as 12.2 cm of irrigation water were saved with no yield reduction, even though water use was reduced. (Skogerboe-Colorado State)
W79-08008

RESPONSES OF A STANDARD AUSTRALIAN AND A MEXICAN WHEAT TO TEMPERATURE AND WATER STRESS,
Commonwealth Scientific and Industrial Research Organization Canberra (Australia). Div. of Plant Industry.
J. L. Davidson, and J. W. Birch.
Australian Journal of Agricultural Research, Vol. 29, No. 6, p 1091-1106, Nov. 1978, 7 fig, 3 tab, 30 ref.

Descriptors: *Crop response, *Wheat, *Drought tolerance, *Soil-water-plant relationships, *Consumptive use, *Moisture stress, Crop production, Irrigation effects, Water utilization, Water requirements, Heat resistence, Differential thermal analysis, Varieties, Environmental effects, Efficiencies, Flowering.

Effects of temperature and water stress treatments imposed after anthesis on 2 varieties of spring wheat, Australian Gabo and Mexican Pitic 62, were studied to determine environmental factors on crop yields. Post treatment dry matter contents taken as biological indices of 9 simulated environments indicated that grain yields of Pitic 62 were consistently higher than those of Gabo. Characteristics believed to contribute to this are: (1) by anthesis this variety produced larger ears from a given weight of supporting tissue, and (2) after anthesis, it mobilized a higher percentage and amount of stem and leaf material to increase the grain production. Two broad categories of shoots were distinguishable and harvest index values varied with both shoot category and size of shoot or plant. The first 4 shoots of both varieties were water-stress tolerant and experienced stress only after anthesis, while younger shoots experienced stress earlier in development and were found to be stress sensitive. In terms of water use, dry matter production, and grain yield, both varieties were found to be similar in response to both temperature and water stress, with highest yields occuring at 21/16 C and water use efficiencies increasing with decreasing water supplies. (Tickes-Arizona)
W79-08015

DROUGHT RESISTANCE IN SPRING WHEAT CULTIVARS. I GRAIN YIELD RESPONSES,
Centro Internacional de Mejoramiento de Maiz y Trigo, Mexico City.
R. A. Fischer, and R. Maurer.
Australian Journal of Agricultural Research, Vol. 29, No. 5, p 897-912, September 1978, 3 fig, 7 tab, 18 ref.

Descriptors: *Drought tolerance, *Plant physiology, *Soil-water-plant relationships, *Crop response, *Wheat, *Varieties, Dry farming, Crop production, Consumptive use, Plant growth, Irrigation effects, Barley, Environmental effects, Moisture stress, Physiological ecology, Grains(Crops), Water utilization, Mexico.

This study of specific drought resistence mechanisms of several varieties of wheat under cultivation in arid northwest Mexico was conducted over three seasons by permanently terminating irrigation at various stages before anthesis. Detailed measurements of plant water status, leaf area, dry matter production, anthesis date, yield components, and grain yield were made. Results indicate a linear relationship between cultivar yield and drought intensity, with mean yield of all cultivars ranging from 37-86 percent of the control yield. This corresponds to irrigation cutoffs, varying from 69 days before mean anthesis date, to only 10 days prior. A consideration of cultivar yield under drought as a function of yield potential, drought susceptibility, and intensity of drought indicates that tall bread wheats and barleys had the highest drought resistance values, while dwarf bread wheats were intermediate, and durum wheats and triticales the most susceptible. Dwarf wheats, however, did have a higher yield potential than tall bread wheats, suggesting that only under severe drought conditions can tall bread wheats outyield the dwarfs. Highly significant differences of grain yield under drought appear to be constant between years, and in agreement with international trials under dryland conditions. (Tickes-Arizona)
W79-08017

RESIDUAL EFFECTS OF SUMMER IRRIGATION ON MOJAVE DESERT ANNUALS,
California Univ., Riverside. Dept. of Biology.
H. B. Johnson, F. C. Vasek, and T. Yonkers.
Bull. Southern California Academy of Sciences, Vol. 77, No. 3, p 95-108, 1978. 1 fig, 6 tab, 36 ref.

Descriptors: *Irrigation effects, *Crop response, *Environmental effects, Irrigation efficiency, Crop production, Consumptive use, Vegetation effects, Environmental gradient, Vegetation establishment, Germination, Annuals, Vegetative communities, Mojave Desert, Soil-water-plant relationships, Sprinkler irrigation, Rainfall, Slopes, Creosote bush, Shrubs.

Two distinct groups of annual appear to have evolved in the deserts of southwestern North America: the summer annuals which germinate in response to sufficient precipitation during periods of high temperature, and the winter annuals that germinate in response to sufficient precipitation during periods of low temperature. Because the progression of events which lead to the conditions required for the germination and development of these annuals has been a concern of botanists through the years, the purpose of the present study was to determine the response of summer and winter annuals to early summer irrigation and/or natural rainfall on both a rocky slope and a sandy bajada near east Ord Mountain in the Mojave Desert, California. Two sites representing different phases of the creosotebush scrub community were selected for sprinkler irrigation from an imported 450-gallon tank which together with two summer storms in the area made it possible to analyze the results of a combination of irrigation and natural rainfall treatments. Somewhat unexpected results indicated that irrigation stimulated germination in summer annuals on the rocky slope but not on the bajada where a late summer storm produced a progression of annuals while during the following season winter annuals showed markedly reduced densities on both irrigated plots and on the area receiving summer rain, annuals which comprised over 80% of the plant species in both sites exhibit greater spatial heterogenity than the perennial communities and it was concluded that summer precipitation may have a greater influence upon vegetation response than has been previously supposed. (Tickes-Arizona)
W79-08019

THE EFFECTS OF SALINE IRRIGATION WATER AND GYPSUM ON PERENNIAL PASTURE GROWN ON A SODIC, CLAY SOIL AT KERANG, VICTORIA,
Victoria Dept. of Agriculture, Kerang.
For primary bibliographic entry see Field 5C.
W79-08020

GENERAL FUNCTIONS AND VALUES OF FRESHWATER WETLANDS IN THE GLACIATED MIDWEST,
Eastern Michigan Univ., Ypsilant. Dept. of Geography and Geology.
For primary bibliographic entry see Field 2H.
W79-08275

INTERRELATIONS OF THE PHYSICAL PROPERTIES OF COPPICE DUNE AND VESICULAR DUNE INTERSPACE SOILS WITH GRASS SEEDLING EMERGENCE,
Texas A and M Univ., College Station. Dept. of Range Science; and Max C. Fleischmann Coll. of Agriculture, Reno NV. Renewable Natural Resources Div.
For primary bibliographic entry see Field 2G.
W79-08348

EFFECT OF IRRIGATION INTERVAL AND PLANT POPULATION ON GROWTH, YIELD AND WATER USE OF SOYBEANS IN A SEMI-ARID ENVIRONMENT,
New South Wales Dept. of Agriculture, Leeton.
J. A. Thompson.
Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. 18, No. g1, p 276-281, April 1978, 4 tab, 4 fig, 14 ref.

Descriptors: *Irrigation practices, *Water management(Applied), *Irrigation effects, *Timing, *Plant populations, *Crop response, *Plant growth, *Environmental effects, *Soybeans, Water utilization, Consumptive use, Planting management, Productivity, Rates of application.

Reported are the results of an experiment conducted to examine the effects of two irrigation intervals and three plant populations on yield and water use of soybeans in a semi-arid environment at the Leeton agricultural Research Station, New South Wales. An experimental design in which plant populations of 12, 20, and 28 plants per square meter were furrow-irrigated at irrigation intervals of 70 mm and 140 mm of estimated evapotranspiration was used to indicate that while plant population had little influence upon plant performance or water use, highly significant differences were found between the two irrigation intervals. A 34 percent reduction in seed yield was indicated at the 140 mm interval principally due to a decrease in the number of pods per plant, and little effect on either protein or oil content of the seed was found. Water use was found to be 75 percent of pan evaporation under the 70 mm interval and 15 percent lower under the 140 mm interval, although protein and seed production was less efficient under the latter. While peak soil moisture demands appear to coincide with the end of flowering early

pod fill period, more work is required to define the growth stage at which soybeans are most sensitive to soil water conditions. (Tickes-Arizona)
W79-08365

GRASSLAND PRODUCTIVITY: THE DESERT END OF THE CURVE,
Transvaal Museum, Walvis Bay (South Africa). Desert Ecological Research Unit.
M. K. Seely.
South African Journal of Science, Vol. 74, No. 8, p 295-297, August 1978, 4 fig, 1 tab, 18 ref.

Descriptors: *Soil-water-plant relationships, *Plant growth, *Productivity, *Crop response, *Regression analysis, Water requirements, Grasslands, Rainfall, Namib desert.

Numerous studies of the relationship between rainfall and plant production have been carried out to date in Southwest Africa, Australia, and Tunisia where annual precipitation ranges from 100 to 1500 mm. The purpose of the present paper is to describe this relationship in the extremely low rainfall region of the Central Namib Desert along the southwestern coast of Africa and to compare it with results obtained in other desert areas. Simple rain gauges were erected during the summer of 1973-74 at 2 km intervals extending 44 km ENE from Gobabeb along a transect intersecting the area where the western boundary of the grass cover may occur. In March 1974, following an unusually heavy rainfall, five 1-meter-square quadrants were clipped at ground level near each rain gauge along the transect and standing crop was measured and related to rainfall. Results indicated values of 0 to 49.9 g m2 for rainfall varying from 11 to 96 mm with an average dry matter of 0.5 mg dry matter g1. Comparison of these regression lines with those obtained 40 years earlier for nearly grasslands experiencing higher annual precipitation, and those of a decade earlier for numerous sources of varied rainfall regimes indicate that the regression line slopes are significantly different. (Tickes-Arizona)
W79-08366

WATER AWARE-II: LANDSCAPING AND IRRIGATION TECHNIQUES TO CONSERVE WATER. OUTDOOR RESIDENTIAL WATER CONSERVATION HINTS FOR ARIZONA HOUSEHOLDS,
Water Resources Research Center, Tucson, AZ.
Arizona Water Resources Project Information, Project Bulletin No. 20, June 1979, 1 fig, 8 ref.

Descriptors: *Landscaping, *Planting management, *Vegetation establishment, *Water conservation, *Plant groupings, Water requirements, *Irrigation efficiency, Soil-water-plant relationships, Irrigation practices, Water reuse, Arizona.

Landscaping attitudes and traditions brought to the Southwestern U.S. from Spain and Mexico which utilized the concept of water as a limited resource have largely been displaced by attitudes transplanted from water-abundant regions in the Eastern and central U. S. The impending culture shock induced by water scarcity which has resulted is discussed here, with emphasis upon outdoor residential water conservation hints for Arizona households. Included are helpful suggestions concerning landscape design criteria, landscape plant selection, irrigation tips, irrigation methods, and the potential utilization of recycled water. Design function and general water requirements are categorized by: Space defining plants, Shade and shelter, Foundation plants, Groundwater plants, Vines, Bedding plants, and Accent. (Tickes-Arizona)
W79-08370

CLIPPING OF WATER-STRESSED BLUE GRAMA AFFECTS PROLINE ACCUMULATION AND PRODUCTIVITY,
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
K. Wisiol.
Journal of Range Management, Vol. 32, No. 3, May 1979, p 194-195, 2 tab, 17 ref.

Descriptors: *Crop response, *Cutting management, *Moisture stress, *Grama grasses, *Amino acids, Drought tolerance, Range management, Pasture management, Range grasses, Halophytes, Proteins, Proline.

Proline, a protein component classed with the amino acids, has been observed to accumulate to abnormal levels in many species of water-stressed vernalized or halophytic plants. To determine if this proline accumulation can be used to indicate the regrowth potential of range grass, proline concentration and productivity were measured in 8 month old blue grama (Bouteloua gracilis) plants grown from Lovington-variety seed from New Mexico and subjected to water stress, clipping, or both in two growth chamber experiments. Results indicated that clipping of plants prior to water stress reduced proline accumulation in the bases of the stressed shoots and increased herbage production, while post water stress clipping speeded up the accumulation of proline in the shoot bases. (Tickes-Arizona)
W79-08375

GRAZING ON WETLAND MEADOWS,
Georgia Univ., Brunswick. Marine Resources Extension Center.
For primary bibliographic entry see Field 4C.
W79-08469

MANAGEMENT OF WETLANDS FOR WILDLIFE HABITAT IMPROVEMENT,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
R. H. Chabreck.
In: Estuarine Processes, Volume I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 226-233 28 ref.

Descriptors: *Wetlands, *Wildlife, *Habitat, *Management, Coastal marshes, Water levels, Salinity, Ditches, Birds, Mammals, Foods, Aquatic weeds, Rooted aquatic plants.

Population levels of sporting and commercial wildlife species occupying wetlands are a product of the quantity and quality of habitat available. The rapid loss or modification of wetland habitat by other land-use practices has increased the need for special management to maintain or improve habitat quality. Habitat management practices should be designed to regulate the species composition, density, and distribution of plants. Major factors affecting plant growth in coastal wetlands are water levels and salinity, and the management practices applied should be those best suited to local conditions for maintaining these variables within acceptable limits. Special attention must be given to other needs of the wildlife species involved, because factors other than plants are also important components of favorable habitat. Management practices currently used in coastal wetlands are shallow water impoundments, water control structures in drainage systems, marsh ditches, and artificial potholes. Other treatments frequently applied are marsh burning, herbicidal treatment, and planting. (Stihler-Mass)
W79-08470

CRAFT INDUSTRIES FROM COASTAL WETLAND VEGETATION,
Miami Univ., Coral Gables, FL.
J. F. Morton.
In: Estuarine Processes, Vol. I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 254-266. 31 ref.

Descriptors: *Wetlands, *Vegetation, *Rooted aquatic plants, *Industrial production, Trees, Grasses, Cattails, Ferns, Industries.

Useful coastal plants have long been prized. The portia tree, Thespesia populnea, and the related mahoe, Hibiscus tiliaceus, both yield useful wood and inner bark. Mangroves provide nearly indestructible wood, flexible branches for fish traps and tannin for dyes. The leather fern Acrostichum, furnishes edible fiddleheads and tough fronds for thatching. In the East Indies and Polynesia, Pandanus tectorius is an indispensable source of leaf products. Much building material in the form of woven matting is supplied by palms. The moriche, Mauritia flexuosa, is the main fiber provider in the Orinoco delta. Cattails, Typha spp., are utilized in many ways on a worldwide scale. Sedges and grasses have served widely for hut-building, thatching, screens, matting, baskets, brooms and cordage. (Stihler-Mass)
W79-08472

PHARMACOLOGICAL POTENTIAL OF MARSH PLANTS,
Mississippi State Univ., Mississippi State. Dept. of Chemistry.
D. H. Miles, and A. A. de la Cruz.
In: Estuarine Processes, Volume I, Uses, Stresses, and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 267-276. 4 fig, 3 tab, 14 ref.

Descriptors: *Rooted aquatic plants, *Marshes, *Public health, Wetlands, Tidal marshes, Pharmacology, Cancer.

The alkaloids in three species of vascular plants abundant in Mississippi tidal marshes were analyzed. An unexpectedly high amount (2.0 g/kg) of total alkaloidal fraction was found in adult Juncus roemerianus and as much as 1 5 g/kg in Spartina cynosuroides and Scirpus americanus. Indole was also identified in the volatile constituents of S. cynosuroides. Since two of the most potent antileukemic agents are dimeric indole alkaloids, crude extracts from these plants were sent to the National Cancer Institute for screening of their possible antitumor activity. These tests have resulted in the detection of significant activity in 12 species of marsh plants. Further examination of the extract of J. roemerianus has resulted in the isolation of the new tumor inhibitor, juncusol. Antitumor agents are currently being isolated from the other marsh plants which have demonstrated significant activity. (Stihler-Mass)
W79-08473

TRACE METAL CYCLES IN SEAGRASS COMMUNITIES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
W. Pulich, S. Barnes, and P. Parker.
In: Estuarine Processes, Volume I, Uses, Stresses, and Adaptations to the Estuary, M. Wiley, editor, Academic Press, New York, N Y., 1976, p 493-506. 4 fig, 4 tab, 17 ref.

Descriptors: *Metals, *Rooted aquatic plants, *Wetlands, Iron, Manganese, Zinc, Copper, Nutrients, Texas, Seasonal, Seagrass.

Processes which make essential trace metals, as well as other nutrients, readily available may account for the distribution of and patterns of succession in seagrass meadows. Complete inventories of Fe, Mn, Zn, and Cu were compared for the five species of Texas seagrasses from study areas in Redfish Bay and Northern Laguna Madre. Seasonal fluctuations in an area were minimal, while major areal differences between plants in Laguna Madre and Redfish Bay were detected. The seagrasses from Laguna Madre contained more Mn and less Fe (Halodule lead avg. Fe/Mn ratio = 0.37, avg. Mn = 250 ppm) than Redfish Bay plants (Halodule leaf avg. Fe/Mn ratio = 4.0, avg. Mn = 90 pps), although sediments from Laguna Madre had 50% lower concentrations of leachable (i.e. 'available') Fe and Mn than Redfish Bay sediments. Measurements showed that seagrass detritus remained high in the 4 trace metals; thus unless the detritus is recycled at its source of production, large amounts of metals will be removed from the ecosystem. We suggest that recycling of detritus and gradual release of nutrients into the water column in the closed Laguna Madre system may be more advantageous to seagrass growth than increased levels of trace metals in the sediments of a more open system such as Redfish Bay. (Stihler-Mass)
W79-08475

NUTRIENT EXCHANGES BETWEEN BRACKISH WATER MARSHES AND THE ESTUARY,
Horn Point Environmental Lab., Cambridge, MD.
J. C. Stevenson, D. R. Heinle, D. A. Flemer, R. J. Small, and R. A. Rowland.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 219-240. 8 fig, 1 tab, 42 ref.

Descriptors: *Nutrients, *Marshes, *Estuaries, Wetlands, Nitrogen, Oxygen, Phosphorus, Respiration, Photosynthesis, Brackish water, Chesapeake Bay.

A 5.7 ha marsh on the Choptank River was monitored monthly from October 1974 to August 1975 for dissolved inorganic nitrogen and phosphorus. During these diurnal samplings, nutrient exchange with the estuary was eliminated by a tidal gate and total aquatic oxygen metabolism was measured. During winter, photosynthesis exceeded respiration, and total nitrogen increased to 80 microgram atoms/l and declined through spring to 8 microgram atoms/l. Phosphate varied erratically from 0.8 to 4.3 microgram atoms/l. During winter, there appears to be a net flow of inorganic nitrogen and phosphorus to the estuary. In spring this pattern is reversed. Two years' tidal flow data from a 127 ha marsh on the Patuxent River revealed that dissolved inorganic nitrogen is also taken up in May, June and July. When the dissolved organic fraction is also considered, net nitrogen flow was always to the estuary. Estimated nitrogen flux to the estuary was 4.14 g/sq m/hr. Net annual flux of dissolved phosphorus to the estuary was 0.19 g/sq m/yr. Brackish marshes appear to act more as sources of nutrients to the estuary than do high salinity marshes. (Stihler-Mass)
W79-08476

NITROGEN POOLS AND FLUXES IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2G.
W79-08477

BENTHIC DETRITUS IN A SALTMARSH TIDAL CREEK,
Virginia Univ., Charlottesville. Dept. of Environmental Studies.
J. C. Pickral, and W. E. Odum.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, NY., 1976. p 280-292, 5 fig, 1 tab, 30 ref.

Descriptors: *Detritus, *Salt marshes, *Streams, Marshes, Wetlands, Sediments, Seasonal, Vegetation, Storms, Methodology.

A new benthic sampling device was developed to permit convenient, quantitative collection of organic detritus from submerged sediment surfaces. The apparatus was used to investigate the spatial and temporal distribution of benthic detritus in a tidal, saltmarsh creek adjacent to the York River, Virginia. Diurnal, monthly, and seasonal samples were collected and partitioned into detrital size fractions. Each size fraction was analyzed to determine the percentage of root, stem, and leaf tissue contributed by the dominant marsh plants. The standing stock and composition of detritus varied in a characteristic manner across the width and along the length of the tidal creek. Temporal differences were also evident, especially those associated with periodic storms. The data indicate apparent relationships between the morphology of the creek, current velocities, substrate texture, and the distribution and composition of the benthic detritus. (Stihler-Mass)
W79-08478

CARBON RESOURCES OF A BENTHIC SALT MARSH INVERTEBRATE: NASSARIUS OBSOLETUS SAY (MOLLUSCA: NASSARIIDAE),
Georgia Univ., Athens. Dept. of Zoology.
R. L. Wetzel.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N Y., 1976, p 293-308. 5 fig, 4 tab, 30 ref.

Descriptors: *Mollusks, *Snails, *Carbon, *Salt marsh, Mud flats, Ecology, Microorganisms, Algae, Marshes, Wetlands.

The mud snail, Nassarius obsoletus Say, occupies the intertidal mud flat area of the salt marsh ecosystem at Sapelo Island, Georgia, and is classed as a detritovore The three principal carbon resources available for ingestion by the intertidal population are Spartina alterniflora Loisel derived carbon (plant detritus), microbial carbon (bacteria), and benthic algae (primarily pennate diatoms). Uptake studies using C14 labeled substrates indicated that the structural carbohydrate fraction (crude fibre) of the plant detritus was not assimilable. Uptake and retention of C14 by N. obsoletus occurred only on microbial and algal labeled substrates. Extrapolating the calculated short term uptake and retention rates to a daily basis for these two carbon resources, total incorporation would balance a daily body carbon loss of 5 to 6%. There was evidence from the uptake studies that N. obsoletus functions more as a 'grazer' on the mud flat area than a strict detritovore. Label uptake was approximately 2.3 times greater on the algal substrate than the microbial and ingestion significantly reduced algal standing crop in the experimental cores. Net carbon retention efficiency for both substrates was 46%. (Stihler-Mass)
W79-08479

CONTRIBUTION OF TIDAL MARSHLANDS TO MID-ATLANTIC ESTUARINE FOOD CHAINS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. R. Heinle, D. A. Flemer, and J. F. Ustach.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 309-320. 3 fig, 3 tab, 30 ref.

Descriptors: *Tidal marshes, *Estuaries, *Anadromous fish, *Copepods, *Foods, Marshes, Coastal marshes, Wetlands, Invertebrates, Detritus, Fish.

The seasonal pulsing of flows of carbon from tidal marshes results in similarly pulsed production of zooplankton in some estuaries. Direct evidence, experimental feeding of laboratory copepods, and measurements of feeding by captured wild copepods, supports the hypothesis that detritus is rapidly incorporated into higher trophic levels. The timing of the production of copepods based on a detrital food source is such that year-to-year variations in amount may be an important factor in the survival of larvae of anadromous fish. (Stihler-Mass)
W79-08480

RIVER PLANTS: THE MACROPHYTIC VEGETATION OF WATERCOURSES,
Cambridge Univ. (England). Botany School.
S. M. Haslam.
Cambridge University Press, Cambridge. 1978. 396 p.

Descriptors: *Aquatic plants, *Rivers, *Ecology, *Ecological distribution, *Rooted aquatic plants, Algae, Vegetation, Submerged plants, Flow, Width, Wetlands, Light, Grazing, Herbicides, Pollution, Dredging, Erosion, Turbidity, Geology, Productivity, Great Britain, Canada, United States.

The effects on the distribution of riverine plants of river width, drainage, order, depth, flow and substrate, light and shading (from above and due to turbidity), siltation and nutrients, surficial geology (soft versus hard rock base) and pollution are discussed in detail. The effects of flow and substrate on individual plants (hydraulic resistance to flow, anchoring strength, velocity pull, battering and tangling, abrasion, root depth and pattern, erosion and sedimentation) are also examined. Most examples are taken from British rivers, but three chapters are devoted to the vegetation within the streambed and to techniques for maintaining watercourses (dredging, plant cutting, herbicides, shading, grazing). Productivity is discussed briefly A glossary and index are provided. (Stihler-Mass)
W79-08482

THE NATURAL ENVIRONMENTS OF GEORGIA,
Georgia State Univ., Atlanta.
C. H. Wharton.
Geologic and Water Resources Division and Resource Planning Section, Office of Planning and Research, Georgia Department of Natural Resources, Atlanta, 1978. 227 p, 110 fig, 349 ref, 6 append.

Descriptors: *Georgia, *Habitats, *Wetlands, Classification, Springs, Aquifers, Rivers, Streams, Marshes, Salt marshes, Ponds, Bogs, Beaver.

One hundred natural environments of Georgia are discussed including 39 hydric systems (systems where standing or flowing surface water is visible for substantial portions of the day, month or year). Included are various types of springs, river and stream systems, marshes, ponds, swamps, and bogs. Location, description, flora and fauna of each environment are discussed as are natural and cultural values, man's uses and man's impacts. The physiographic classification and paleohistory of Georgia are discussed briefly. Photographs of many environments are included. (Stihler-Mass)
W79-08484

WATER RELATIONS OF PLANT SPECIES IN THE WET COASTAL TUNDRA AT BARROW, ALASKA,
San Diego State Univ., CA. Dept. of Biology.
W. A. Miller, and P. C. Miller.
Arctic and Alpine Research, Vol. 7, No. 2, p 109-124, 1975. 9 fig, 6 tab, 68 ref.

Descriptors: *Rooted aquatic plants, *Tundra, *Ecology, Pacific Coast Region, *Water relations, Alaska, Wetlands, Ponds, Photosynthesis, Stress, Model studies.

Various aspects of the water relations of six species (Arctophila fulva, Dupontia fischeri, Carex aquatilis, Eriophorum angustifolium, Potentilla hyparctica, and Salix pulchra) characteristic of the wet coastal tundra near Barrow, Alaska, were measured during the summers of 1972 and 1973. Lower leaf water potentials occur in the plants of the Barrow area than previously reported. Minimum leaf resistances, cuticular resistances, and threshold water potentials are similar to those of mesic species in alpine and more temperate areas. Arctophila may be confined to ponds and Dupontia to the moist Arctic coast because of stomatal sensitivity to water loss. Midday leaf water potentials low enough to cause some stomatal closure occurred throughout the 1972 season in Dupontia; throughout the 1973 season in Arctophila, Dupontia and Potentilla. Results of this study support the hypothesis that water stress can limit photosynthesis of plants in the wet coastal tundra around Barrow. (Stihler-Mass)
W79-08485

THE EFFECT OF REEDS ON THE WATER CHEMISTRY OF GNADENSEE (BODENSEE),
Baden-Wuerttemberg Landesstelle fuer Gewaesserkunde und Wasserwirtschaftliche Planug. Karlsruhe (Germany, F.R.).
For primary bibliographic entry see Field 2K.
W79-08486

ENERGY CONTENT IN THE BIOMASS OF EMERGENT MACROPHYTES AND THEIR ECOLOGICAL EFFICIENCY,
Ceskoslovanska Akademie Ved. Trebon. Dept. of Hydrobotany.
D. Dykyjova, and S. Pribil.
Archiv fur Hydrobiologie, Vol. 75, No. 1, p 90-108, February, 1975. 5 tab, 30 ref.

Descriptors: *Aquatic plants, *Ecological productivity, *Aquatic habitats, *Communities, Wetlands, Biomass, Solar radiation energy, Energy conversion, Reedswamp.

Energy contents were determined for dominant species in the highly productive reedswamp communities. In the photosynthetic organs, the energy contents are highest in the spring (in the young parts), and may fall during the growing season. Fruits and flowers have a higher energy content than the vegetative part and the belowground storage organs. The calculated efficiency coefficients of incident global radiation are relatively very high. The caloric values are compared with other author's data as well as with the comparable values on floating and submerged macrophytes. (Hinkel-Mass)
W79-08488

SUBMERSED AQUATIC VASCULAR PLANTS IN ICE-COVERED PONDS OF CENTRAL OHIO,
Ohio State Univ., Columbus. Dept. of Botany.
R. L. Stuckey, J. R. Wehrmeister, and R. J. Bartolotta.
Rhodora, Vol. 80, No. 824, p 575-580, October, 1978. 22 ref.

Descriptors: *Rooted aquatic plants, *Winter, *Ponds, Wetlands, Vegetation, Submerged plants, Competition, Life history studies, Ohio.

The presently accepted life histories of many submersed aquatic vascular plants which assume perennation exclusively by various types of specially formed dormant structures deserve re-evaluation. The addition of a slow-growing or dormant phase in the vegetative condition could appropriately be integrated into our present concepts of the life histories of many of these species. The success of some 'weedy' invaders or aggressive competitors may be correlated with their ability to remain in a vegetative condition throughout the winter; with the onset of melting ice, such plants are already active photosynthetically. (Stihler-Mass)
W79-08491

THE ROLE OF SEED BANKS IN THE VEGETATION DYNAMICS OF PRAIRIE GLACIAL MARSHES,
Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.
A. G. van der Valk, and C. B. Davis.
Ecology, Vol. 59, No. 2, p 322-335, early Spring, 1978. 2 fig, 6 tab, 28 ref.

Descriptors: *Freshwater marshes, *Seeds, *Germination, Lakes, Marshes, Wetlands, Rooted aquatic plants, Vegetation, Submerged plants, Succession, Ecology, Mud flats, Iowa, Water level fluctuations, Muskrats.

The presence of viable seed in 24 substrate samples from Eagle Lake, a marsh in northcentral Iowa, was tested by placing subsamples of each sample under two environmental conditions. One set of samples was placed under water (submersed treatment). Seeds of 20 species germinated and grew. There was an average of 8.3 species/sample. The second treatment was a simulation of conditions on an exposed mud flat (drawdown treatment). Under drawdown treatment an average 12.9 species germinated/sample. Seeds of 40 species germinated under this treatment of which only 25 percent were also found in the submersed treatment. Seed banks in the six vegetation types samples were estimated to range from 21,445 to 42,610 seeds/sq m on the average in the upper 5 cm of soil. Field studies at Eagle Lake (1974) and nearby Goose Lake (1976), when these marshes had no standing water, revealed that the most abundant species whose seeds germinated on exposed mud flats were the same as the most abundant species germinating in the drawdown experiment. In 1975 Eagle Lake had standing water and the submersed and floating species that were found were the same as those germinating in the submersed experimental subsamples. (Stihler-Mass)
W79-08492

FUNGI FROM NANTUCKET SALT MARSHES AND BEACHES,
North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences.
R. V. Gessner, and B. J. Lamore.
Rhodora, Vol. 80, No. 824, p 581-586, October, 1978. 21 ref.

Descriptors: *Aquatic fungi, *Salt marshes, *Beaches, Marshes, Wetlands, Fungi, Ecological distribution, Rooted aquatic plants, Aquatic plants, Massachusetts, Nantucket(MA).

The fungi of Nantucket salt marshes and beaches, reported in this limited study, appear to be similar to those of mainland New England. The geographical distribution of the marine fungi reported here appears to be influenced by water temperatures and the distribution of host plants. (Stihler-Mass)
W79-08493

SOME MIDSUMMER DIATOM ASSEMBLAGES ALONG THE SALINE GRADIENT OF A SMALL COASTAL STREAM IN KACHEMAK BAY, ALASKA,
Rutgers - The State Univ., Newark, NJ. Dept. of Botany.
J. D. Koppen, and J. H. Crow.
Botanica Marina, Vol. 21, p 199-206, 1978. 2 fig, 4 tab, 26 ref.

Descriptors: *Alaska, *Diatoms, *Streams, Salinity, Tides, Coastal areas, Algae, Ecological distribution, Ecology.

Silver Creek, a coastal stream, was sampled for mid-summer diatom assemblages. Two upstream stations with a constant supply of freshwater were dominated with oligohalobous and a few euryhalobous forms. Midstream sites were dominated by mesohalobous and euryhalobous taxa indicative of increased brackish water and tidal influence. Dominance by mesohalobous forms at downstream locations along with a substantial decrease in the proportion of euryhalobous forms can be attributed to increased salinity and decreased salinity fluctuations. (Stihler-Mass)
W79-08494

MARL ENCRUSTATION ON HYDROPHYTES IN SEVERAL MICHIGAN LAKES,
Michigan Univ., Ann Arbor. Dept. of Fisheries.
R. G. Wetzel.
Oikos, Vol. 11, No. II, p 223-236, 1960. 2 fig, 1 tab, 70 ref.

Descriptors: *Marl, *Rooted aquatic plants, *Lakes, Wetlands, Submerged plants, Phytoplankton, Periphyton, Bacteria, Alkaline water, Carbonates, Calcium compounds, Ecology, Waves, Michigan.

Representative hydrophyte samples were taken from comparative transects in four bodies of water in southeastern Michigan. The amount of monocarbonate marl deposit per gram of plant material (dry weight) was determined. Among the areas investigated, differences in marl encrustation were slight for like species under similar environmental conditions. Considerable variation in deposition was found among different species. Among emergent and floating hydrophytes, capable of direct utilization of atmospheric carbon dioxide, encrustation on the submerged portions was highly variable and proportional to the extent of development of attached periphyton. Among submerged species, deposits are considerably greater and variations are correlated with several factors including morphological variations and differential bicarbonate utilization. Intraspecific variations were also found, with encrustation increasing with increasing depth on the individual hydrophyte. Mechanical removal of the brittle deposits induced by surface wave action is the primary factor decreasing surface encrustation. Agencies of marl formation are discussed. (Stihler-Mass)
W79-08495

ABOVEGROUND PRODUCTION OF SEVEN MARSH PLANT SPECIES IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
C. S. Hopkinson, J. G. Gosselink, and R. T. Parrondo.
Ecology, Vol. 59, No. 4, p 760-769, Summer, 1978. 3 fig, 3 tab, 30 ref.

Descriptors: *Primary productivity, *Rooted aquatic plants, *Louisiana, Wetlands, Marshes, Coastal marshes, Biomass, Productivity, Vegetation, Aquatic plants.

Results of a two-year evaluation of above-ground production of 7 plant species commonly found in Louisiana's coastal marshes show a generally higher level of production compared to other studies. In five of the seven species significant growth occurred throughout the year. Calculated annual production in grams per square metre for each species was: Distichlis spicata, 3237; Juncus roemerianus, 3416; Phragmites communis, 2318; Sagittaria falcata, 1501; Spartina alterniflora, 2658; Spartina cynosuroides, 1355; and Spartina patens, 6043. Sampling variability, expressed as the ratio of the standard error to the mean x 100, averaged between 8 and 18 for different species. Instantaneous loss rates (mg/g/day) of dead vegetation from the marsh, averaged over the year, ranged from 4.7 for P. communis to 25.2 for S. falcata. (Stihler-Mass)
W79-08496

VEGETATION AND PRODUCTION OF THE WOODBURY CREEK-HESSIAN RUN FRESHWATER TIDAL MARSHES,
Rutgers - The State Univ., Camden, NJ. Dept. of Biology
R. E. Good, and N. F. Good.
Bartonia, Vol. 43, p 38-45, 1974-1975. 2 fig, 4 tab, 6 ref.

Descriptors: *Primary productivity, *Rooted aquatic plants, *Tidal marshes, *Freshwater marshes, *New Jersey, Wetlands, Cattails, Wild rice, Standing crops, Energy.

The Woodbury Creek-Hessian Run marshes are strongly dominated by extensive stands of wild rice. Wild rice also occurs in mixtures with spatterdock, bur marigold, water hemp, smartweed and arrowhead. Wild rice is probably the most productive plant of the marshes with peak aboveground standing crop exceeding 1400 g/sq m and peak below-ground standing crop approximating 900 g/sq m. Peak aboveground standing crops for other community types are considerably lower than wild rice, but belowground standing crop of perennial species with rhizomes (Nuphar, Peltandra, Typha) exceed those of wild rice. Aboveground standing crop figures obtained for these marshes are in general agreement with those obtained for similar communities at Tinicum and Oldmans Creek. There are no available belowground data for comparison. Caloric values varied little, regardless of species or plant part, with most figures in the range of 4300 plus or minus 300 calories/g ash-free dry weight. (Stihler-Mass)
W79-08497

THE INFLUENCE OF PREHISTORIC CULTURES UPON THE INITIATION AND SPREAD OF BLANKET BOG IN UPLAND WALES,
Kings Coll., London (England). Dept. of Botany.
For primary bibliographic entry see Field 4C.
W79-08499

INFLUENCE OF AQUATIC MACROPHYTES ON THE CHEMISTRY OF SKADAR LAKE, YUGOSLAVIA,
Michigan Univ., Ann Arbor. Great Lakes and Marine Waters Center.
A. M. Beeton, and S. Sikes.
Verh. Internat. Verein. Limnol., Vol. 20, p 1055-1061, October, 1978. 3 fig, 2 tab, 19 ref.

Descriptors: *Rooted aquatic plants, *Water chemistry, *Lakes, *Effects, Wetlands, Littoral, Vegetation, Water quality, Europe, Yugloslavia.

Skadar Lake fluctuates between 360 sq km and 690 sq km due to heavy runoff from winter and spring rains; extensive areas are flooded annually. These flooded areas and an extensive littoral zone support

large beds of aquatic macrophytes. Approximately 22% of the northern end of that lake in summer is occupied by aquatic macrophytes. The chemistry of the lake is similar to that of the Moraca River, its major tributary, from October into early June. The chemical characteristics of lake water differ from the river after aquatic macrophytes become well established in late spring. At this time, specific conductance and alkalinity are lower in the lake than in the river. Low conductivity values are likely to be the result of photosynthesis. (Stihler-Mass)
W79-08500

2J. Erosion and Sedimentation

DEVELOPMENT AND APPLICATION OF SEDIMENT BASINS IN MARYLAND,
Soil Conservation Service, College Park, MD.
S. M. Boysen.
Paper No. 78-2562, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 13 p. 2 fig, 9 ref, 1 append. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment control, Trap efficiency, Soil erosion, Design criteria, Design standards, Specifications, Sediment yield, *Detention reservoirs, Skimming.

Sediment basins are an important part of the sediment control program in Maryland. Criteria were presented for estimating trap efficiency of basins. Experiences and results of field observations were presented. Standards and specifications prepared by the Soil Conservation Service for sediment basins in Maryland were attached. (Skogerboe-Colorado State)
W79-08006

CURRENT-INDUCED SEDIMENT MOVEMENT IN THE DEEP FLORIDA STRAITS: CRITICAL PARAMETERS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2L.
W79-08095

DISPERSION ESTIMATES FOR HYDRAULIC DREDGE SPOIL,
Tippetts, Abbett, McCarthy, and Stratton, New York.
M. R. Pyles, and W. L. Schroeder.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE3, Proceedings Paper 14625, p 571-582, June 1979. 10 fig, 1 tab, 6 ref, 1 append.

Descriptors: *Dredging, *Sands, *Spoil banks, *Dispersion, Model studies, Mathematical studies, On-site investigations, Waste disposal, Sediments, Sedimentation, Settling velocity, Navigation, Harbors, *Hydraulic dredging.

A method for analysis of the location of sandy dredge spoils on the bottom of a receiving water body was developed and confirmed by laboratory and field experimentation. Analysis of laboratory data using the method indicated agreement with observation where the physical environment (pipeline discharge velocity, ambient water velocity, settling velocity of particles) was well defined. Application to field operations confirmed the laboratory results and showed that the simple form of analysis proposed is consistent with the precision of physical environment definition usually obtainable in dredging practices. (Sims-ISWS)
W79-08097

DYNAMIC MODEL FOR CHANNEL BED EROSION,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Mathematical Sciences.
D. A. Drew.
Journal of the Hydraulic Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14634, p 721-736, June 1979. 2 fig, 18 ref, 1 append.

Descriptors: *Bed load, *Erosion, *Sediment transport, *Model studies, Mathematical models, Sediments, Channels, Rivers, Turbulence, Flow, Channel erosion, Channel improvement, Stabilization, Scour, Hydrodynamics, Fluid mechanics, Bedload movement.

A model for the hydrodynamical description of the flow of sediment and water in a thin layer near the bed was presented. Closer assumptions were given for the turbulence terms. A pickup relation for the concentration of sediment above the bed was examined. The behavior of the model was studied for two different simplifying assumptions about the fluid flow above the bed. (Sims-ISWS)
W79-08098

DYNAMICS OF FORMATION OF THE CHANNEL OF THE KARA-KUM CANAL,
Kh. Sh. Shapiro, and T. A. Aliyev.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 241-244, 1977. 4 fig, 2 tab, 6 ref. Translated from Gidrotekhnika i Melioratisiya, No. 4, p 27-32, 1977.

Descriptors: *Canals, *Channel morphology, *Soil strength, *Erosion, On-site investigations, On-site data collections, Model studies, Mathematical models, Soil erosion, Channels, Soils, Roughness coefficient, Roughness(Hydraulics), Soil science, *Kara-Kum Canal(USSR).

Continuous study of channel processes in the Kara-Kum Canal has yielded extensive experimental data. These data can be used to plan and calculate stable channel forms for diversion of part of the flow of Siberian rivers to Soviet Central Asia. Field investigations in 1973-1976 were conducted in three reaches of a total length of 52 km with 39 cross sections. Furthermore, sample measurements were made in the reach from the 57- to the 100-km mark of the canal. Analysis of field data showed that the stability of the bank slopes of large canals is largely determined by the nature of scouring. For example, as flow increases, bank deformation predominates in the reaches of the canal with sandy soils and vertical deformation in reaches with cohesive soils. The ratio of width to average depth in sandy reaches varies from 40 to 85 and in reaches with cohesive soils from 8 to 25. (Sims-ISWS)
W79-08099

GEOMETRY OF RIVERS IN REGIME,
San Diego State Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-08108

IRRIGATION RESERVOIR THAT SILTS UP INSIGNIFICANTLY,
For primary bibliographic entry see Field 2H.
W79-08142

PROTECTION OF THE BANKS OF THE AMU-DAR'YA RIVER FROM DEYGISH BY HYDROMECHANICAL MEANS,
D. L. Melamut, N. K. Golybev, and N. R. Stetsenko.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 248-253, 1977. 6 fig, 2 tab, 6 ref. Translated from Gidrotekhnika i Melioratsiya, No. 5, p 15-23, 1977.

Descriptors: *Bank protection, *Channel improvement, *Bank stabilization, Bank erosion, Bank stability, Dredging, Rivers, Channels, Embankments, Erosion, Sedimentation, Flow, Hydrology, *Amu-Dar'ya River(USSR).

Intense channel deformation in plan, leading to the catastrophic destruction of the banks, i.e., deygish, is typical of the Amu-Dar'ya River. The fine sandy channel bed and the transverse stalling of flow, associated with sharp discharge and water level fluctuations at flood rise and recession, are responsible for such scour. The concave bank is most susceptible to this process. The erosion products are carried by bottom currents toward the convex bank, where they are deposited and increase the forming shoal. The slope of the eroded bank during deygish is steep and nearly vertical in its upper part. Because of the appearance of cracks in the bank, the earth of the bank collapses into the river. A relatively short cut (2-3 km) with a slope exceeding the slope of the flow in the river by a factor of 1.3-1.5 offers the best conditions for diverting a stream and letting it erode the ground. In widening a cut of considerable length with a flowing stream of water, the sediments must be intercepted by dredges near side and midstream bars. In that case, erosion intensifies. Hydraulic filling is effective when several dredges are used to narrow and close the channel. Hydraulic filling should begin from the bank where the flow is deeper so that the gap is closed in the shallow area. In the final stages of work, along with dredges it is advisable to use bulldozers for moving and dumping earth into the stream from dumps on the banks in order to additionally saturate the flow. (Sims-ISWS)
W79-08145

SETTLING BEHAVIOR OF NATURAL AQUATIC PARTICULATES,
Chicago Univ., IL. Dept. of Geophysical Sciences.
R. R. P. Chase.
Limnology and Oceanography, Vol. 24, No. 3, p 417-426, May 1979. 6 fig, 2 tab, 15 ref.

Descriptors: *Settling velocity, *Sediments, *Laboratory tests, Lakes, Oceans, Stokes law, Freshwater, Saline water, Organic matter, Particle size, Sedimentology, Limnology, Oceanography, Aquatic particulates.

The validity of Stokes Law as an approximation to the drag force on sediments (organic-mineral aggregates) from lacustrine and marine environments was examined under controlled laboratory conditions. The settling characteristics of aggregates in the size range of 5-500 micrometers were inconsistent with a Stokesian assumption. Experiments with distilled, organics-free, and natural waters indicated that aggregate behavior is altered by the presence of naturally occurring surface coatings, solution electrolytes, and dissolved organic substances. Although rotational effects appear unimportant, the above factors combine to produce a reduction in overall nonlinear skin friction which is manifested by up to an order of magnitude increase in velocity over the predicted value for an aggregate of mean dimension (approx. 28.5 micrometers). (Sims-ISWS)
W79-08238

THE 210PB CHRONOLOGY OF A CORE FROM MIRROR LAKE, NEW HAMPSHIRE,
Yale Univ., New Haven, CT. Dept. of Geology and Physics.
K. L. Von Damm, L. K. Benninger, and K. K. Turekian.
Limnology and Oceanography, Vol. 24, No. 3, p 434-439, May 1979. 2 fig, 2 tab, 15 ref. Energy EY-76-S-02-3573.

Descriptors: *Sediments, *Cores, *Lake sediments, *Isotope studies, *New Hampshire, Lead, Uranium radioisotopes, Sampling, Lakes, On-site data collections, Chemicals, Chemical analysis, Laboratory tests, Radioactive dating, Sedimentation, Limnology, *Mirror Lake(NH).

A core from Mirror Lake (New Hampshire) was analyzed in detail for 210Pb and other members of the uranium decay series. The core shows periods of episodic redistribution and deposition of contemporaneously deposited indigenous lake sediment to the site interspersed with periods of constant sediment accumulation at an average rate of 0.16 cm/yr. In this lake, 226Ra does not provide a reasonable chronometric tool. (Sims-ISWS)
W79-08239

TWO SEDIMENT TRAP DESIGNS FOR USE IN SMALL RIVERS AND STREAMS,
Freshwater Biological Association, Dorset (England). River Lab.
J. S. Welton, and M. Ladle.

Limnology and Oceanography, Vol. 24, No. 3, p 588-592, May 1979. 1 fig, 2 tab, 8 ref.

Descriptors: *Sediments, *Rivers, *Sampling, *Equipment, Sedimentation rates, Sediment transport, Currents(Water), Gravels, Bed load, Bed load samplers, Beds under water, Streamflow, Sedimentation, Sedimentology, *Sediment traps.

Two sediment traps designed for use in riverine gravels to assess rates, size, and gross quantities of sedimenting material and each having a collecting area of 40 sq cm are small, easy to construct, and easy to handle. The results of the two types of traps used in the gravel bed of a recirculating channel were compared, and recovery efficiencies were given based on laboratory experiments. (Sims-ISWS)
W79-08242

ORGANIC DETRITUS PARTICLES: INITIATION OF MOTION CRITERIA,
Clemson Univ., SC. Dept. of Civil Engineering.
J. S. Fisher, J. Pickral, and W. E. Odum.
Limnology and Oceanography, Vol. 24, No. 3, p 529-532, May 1979. 1 fig, 1 tab, 18 ref.

Descriptors: *Detritus, *Sediments, *Organic matter, Settling velocity, Sediment transport, Laboratory tests, Mathematical models, Equations, Reynolds number, Drag, Density, Sedimentation, Sedimentology, Motion initiation.

The criteria for the initiation of motion for organic detrital sediments appeared to follow the same Shields relationship as sand and other uniform inorganic sediments. The salt marsh tidal creek samples tested included mud particles and stem, leaf particles, and root fragments of marsh grasses. The measurement of particle diameter was replaced with an equivalent diameter determined from fall velocity and density. (Sims-ISWS)
W79-08243

ENRICHMENTS OF ZINC, LEAD, AND COPPER IN RECENT SEDIMENTS OF WINDERMERE, ENGLAND,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W79-08257

LANDSCAPE REDUCTION BY WEATHERING IN SMALL RHODESIAN WATERSHEDS,
Science and Education Administration, Coshocton, OH.
For primary bibliographic entry see Field 2K.
W79-08269

PREDICTION OF SEDIMENT BASIN PERFORMANCE,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W79-08337

2K. Chemical Processes

ISOTOPE AND ION GEOCHEMISTRY OF GROUNDWATERS IN THE MILK RIVER AQUIFER, ALBERTA,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 2G.
W79-08103

DETERMINATION OF THE INITIAL 14C ACTIVITY OF THE TOTAL DISSOLVED CARBON: A REVIEW OF THE EXISTING MODELS AND A NEW APPROACH,
Paris-6 Univ. (France). Lab. de Geologie Dynamique.
For primary bibliographic entry see Field 2F.
W79-08106

ARSENIC SPECIATION IN SEAWATER AND INTERSTITIAL WATERS: THE INFLUENCE OF BIOLOGICAL-CHEMICAL INTERACTIONS ON THE CHEMISTRY OF A TRACE ELEMENT,
Scripps Institution of Oceanography, La Jolla, CA.
M. O. Andreae.
Limnology and Oceanography, Vol. 24, No. 3, p 440-452, May 1979. 9 fig, 2 tab, 27 ref. ONR N00014-75-C-1052.

Descriptors: *Arsenic compounds, *Sea water, *Connate water, *Pacific Ocean, Chemicals, Chemistry, Chemical analysis, On-site data collections, Sampling, Sediments, Biochemistry, Marine biology, Trace elements, Oceanography, Biology.

Four species of arsenic were found in samples of seawater and interstitial water from the northeast Pacific and the continental borderland off southern California: arsenate, arsenite, methylarsonate, and dimethylarsinate. All were present in the photic zone, with a good correlation between photosynthetic activity and the concentration of the methylated arsenicals. There is less arsenite in the surface waters than in the deep waters, suggesting biological uptake and transport. A sharp increase of arsenate at the base of the photic zone indicates rapid regeneration of this species. In the deep waters arsenate is dominant, but arsenite is still present in excess of equilibrium concentrations. No arsenic biomethylation was found in the interstitial waters of oxic and anoxic sediments, but arsenite was present. In Santa Barbara Basin, arsenite accounts for 20% of the arsenic in the interstitial water, the highest proportion found. Total arsenic is lower in the interstitial than in the overlying waters, suggesting removal of arsenic into the solid phases by adsorption or coprecipitation. Biological-chemical interactions and the kinetics of redox reactions are important in influencing the speciation of arsenic. (Sims-ISWS)
W79-08240

BIOLOGICAL PRODUCTION AND THE EXCHANGE OF OXYGEN AND CARBON DIOXIDE ACROSS THE SEA SURFACE IN STUART CHANNEL, BRITISH COLUMBIA,
Oregon State Univ., Corvallis. School of Oceanography.
K. S. Johnson, R. M. Pytkowicz, and C. S. Wong.
Limnology and Oceanography, Vol. 24, No. 3, p 474-482, May 1979. 7 fig, 1 tab, 28 ref.

Descriptors: *Air-water interfaces, *Oxygen, *Carbon dioxide, Sea water, Atmosphere, Marine biology, Plankton, Photosynthetic oxygen, Oceans, Chemistry, Chemicals, Salinity, Sampling, On-site investigations, On-site data collections, Hydrogen ion concentration, Alkalinity, Oceanography, Biology, Photosynthetic bacteria.

The rates at which concentrations of oxygen and carbon dioxide in Stuart Channel changed due to biological production and to exchange with the atmosphere were determined from measurements of the simultaneous changes in oxygen, pH, and titration alkalinity over a 15-day period in July 1976. Carbon dioxide was consumed by plankton at a rate of 10.8 micromol CO2/liter/d. CO2 entered the surface layer by atmospheric exchange at a range of 0.49 micromol CO2/liter/d. The piston velocity was calculated to be 0.0022 cm/s. Oxygen was produced at a rate of 14.1 micromol O2/liter/d, due to photosynthetic activity. The rate of oxygen loss to the atmosphere was 9.8 micromol O2/liter/d. The piston velocity was 0.0016 cm/s. (Sims-ISWS)
W79-08241

LANDSCAPE REDUCTION BY WEATHERING IN SMALL RHODESIAN WATERSHEDS,
Science and Education Administration, Coshocton, OH.
L. B. Owens, and J. P. Watson.
Geology, Vol. 7, No. 6, p 281-284, June 1979. 2 fig, 6 tab, 17 ref.

Descriptors: *Weathering, *Small watersheds, *Geomorphology, *Granite, *Africa, Rocks, Water quality, Foreign countries, Foreign research, Silica, Iron oxide, Aluminum, Potassium, Sodium, Calcium, Magnesium, Geochemistry, Soil analysis, Topography, Geology, Slopes, *Rhodesia, Chemical weathering.

Two small watersheds were studied to determine rates of dissolution of granite in Rhodesia. One watershed (0.91 sq km) is hilly and has an annual rainfall of 1,220 mm, whereas the other (7.33 sq km) is more nearly level and has an annual rainfall of 922 mm. Samples of drainage water were collected weekly for 2 yr. Water samples from the streams were analyzed for SiO2, Al2O3, Fe2O3 (total Fe), K, Na, Ca, and Mg. Elemental levels were found to be relatively constant throughout the year. The flux of elemental removal was calculated from the streamflow rate and chemical concentrations. The loss of each constituent as a result of weathering could be determined after the chemical composition was determined for the parent rock and the weathered product. Knowing the amount of an element lost and its rate of net removal from the watershed, a rate of weathering for granite was calculated as 400 kg/ha/yr for the higher rainfall area, and 150 kg/ha/yr for the lesser rainfall area. These rates can also be expressed as 15.4 and 5.8 mm of rock weathered per 1,000 yr for the two areas, to produce 11.0 and 4.1 mm of soil, respectively. Thus, slope reduction on granite in Rhodesia is 4.4 and 1.7 mm/1,000 yr for the higher and lower rainfall areas, respectively. (Humphreys-ISWS)
W79-08269

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-08394

NITROGEN POOLS AND FLUXES IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2G.
W79-08477

THE EFFECT OF REEDS ON THE WATER CHEMISTRY OF GNADENSEE (BODENSEE),
Baden-Wuerttemberg Landesstelle fuer Gewaesserkunde und Wasserwirtschaftliche Planug, Karlsruhe (Germany, F.R.).
M. W. Banoub.
Archiv fur Hydrobiologie, Vol. 75, No. 4, p 500-521, July, 1975. 8 fig, 3 tab, 20 ref.

Descriptors: *Water chemistry, *Wetlands, *Aquatic plants, *Reed communities, Alkalinity, Conductivity, Nitrogen, Phosphorus.

The chemistry of water among the reed communities in Gnadensee was compared with that of the outer open water. Gradients of increasing Ca, alkalinity, conductivity, total-P, NH sub 4, COD and uv-absorption, or decreasing pH, NO sub 3 and NO sub 2 are met with as one penetrated deeper into the reeds. The shallow water among the reeds exhibited an appreciable stratification due to released material from its mud. Water exchanges between the reed zone and the lake lead to parallel seasonal variations of chemicals in both areas, however a difference in period and magnitude of variation can be traced to the effect of reeds and its mud. The major processes that occurred among the reeds are the decomposition of dead plants and the effect of the latter on the release of materials from the mud. Indication of the loss of mineral nitrogen from the water system among the reeds is attributed to denitrification and release of nitrogen as gas. Based on phosphorus balance, a residence time of water among the reeds averages to 0.9 days. The average standing stocks of material leached from the reeds during submersion constitute less than 1 percent of the theoretical input from both reeds and mud if no allowance is made for water movements. (Hinkel-Mass)
W79-08486

2L. Estuaries

CURRENT-INDUCED SEDIMENT MOVEMENT IN THE DEEP FLORIDA STRAITS: CRITICAL PARAMETERS,

Rhode Island Univ., Kingston. Graduate School of Oceanography.
M. Wimbush, and B. Lesht.
Journal of Geophysical Research, Vol. 84, No. C5, p 2495-2502, May 20, 1979. 7 fig, 2 tab, 20 ref. ONR N00014-76-C-0226.

Descriptors: *Currents(Water), *Ocean currents, *Bottom sediments, *Ripple marks, Sands, Sand waves, Photography, Current meters, Sediments, Sediment transport, On-site investigations, Oceans, Oceanography, *Florida Straits.

A time-lapse movie of the seabed at 710 m in the Florida Straits showed an irregular sequence of sediment ripple migration and suspension events, occupying 17% of the 43-day duration of the record. Sediment in the region was a moderately sorted carbonate medium sand. Simultaneous current meter records at various positions in and above the benthic boundary layer were compared in various ways with the movie record to develop reliable predictive criteria for sediment motions in situ. With initiation and termination of sediment ripple migration predicted to occur when mean current at 3-m elevation is 24 and 22 cm/s, respectively, 96% of the record was correctly predicted. (Sims-ISWS)
W79-08095

THE ASYMPTOTIC DISTRIBUTION OF THE MAXIMUM DEFICIT OF PARTIAL SUMS OF INDEPENDENT RANDOM VARIABLES,

Colorado State Univ., Fort Collins.
F. L. S. Gomide.
Water Resources Research, Vol. 15, No. 2, p 495-497, April 1979. 3 tab, 1 ref. NSF GK-31512X.

Descriptors: *Reservoirs, *Storage capacity, *Model studies, Mathematical models, Markov processes, Theoretical analysis, Mathematics, Statistics, Statistical models, Asymptotic distribution, Random variables.

Studies of storage capacity of reservoirs lead to the problem of finding the distribution of the maximum deficit of partial sums of independent random variables. In this paper, the asymptotic distribution of the maximum deficit was derived using the theory of Markov chains. The range and the adjusted range of partial sums of independent random variables were also discussed. (Sims-ISWS)
W79-08096

FINITE ELEMENT SIMULATION OF WATER CIRCULATION IN THE NORTH SEA,

Southampton Univ. (England). Dept. of Civil Engineering.
C. A. Brebbia, and P. W. Partridge.
Applied Mathematical Modelling, Vol. 1, No. 2, p 101-107, September 1976. 8 fig, 19 equ, 9 ref.

Descriptors: *Finite element analysis, *Simulation analysis, *Water circulation, *North Sea, *Tidal effects, *Storm surge, *Currents, Shallow water, Equations, Mathematical models, Time integration, Friction level, Chezy's coefficient, Systems analysis.

The modelling of tidal effects, storm surges and currents in large bodies of water is considered. The solution is attempted using the evolutionary shallow water equations with velocities and wave heights as unknowns. Two finite element simulation models are described based on six noded triangular elements. Special consideration has been given to the adequacy of the models which were applied to the North Sea only after extensive tests in channels. Results for velocities and wave heights are compared and discussed. A set of conclusions on the applicability and scope of the models is presented. (Bell-Graf-Cornell)
W79-08209

ON THE EFFECT OF PRECIPITATION AND RUNOFF ON COASTAL CIRCULATION IN THE GULF OF ALASKA,

Alaska Univ., Fairbanks. Inst. of Marine Science.
T. C. Royer.
Journal of Physical Oceanography, Vol. 9, No. 3, p 555-563, May 1979. 7 fig, 2 tab, 20 ref. NOAA 03-5-022-56, NSF OCE75-23187.

Descriptors: *Precipitation(Atmospheric), *Runoff, *Ocean circulation, *Coasts, *Alaska, Rainfall, Snowmelt, Streamflow, Rivers, Mountains, Oceans, Gulfs, Circulation, Water circulation, Density, Winds, Wind pressure, Temperature, Hydrology, Oceanography, *Gulf of Alaska.

Surface waters in the Gulf of Alaska undergo a net dilution throughout most of the year since the regional precipitation exceeds evaporation. Recent hydrographic data give evidence that seasonal dynamic height fluctuations in the upper layers (less than 100 m) are well-correlated with the seasonal changes in precipitation and runoff. The precipitation effect is magnified by coastal mountain ranges which enhance the rainfall at or near the coast, contributing freshwater at the coast through runoff. Previous estimates of the offshore precipitation gradient appear to be smaller than those measured recently. Precipitation and runoff alter the dynamic height through salinity changes. This dependence of dynamic height on salinity is possible here because of the high precipitation (more than 130 cm/year), runoff, longshore accumulation of freshwater around the gyre, and the low water temperatures. The coastal sea level is in phase and has nearly the same amplitude as the local dynamic height, though not in phase with heating and cooling. Both the seasonal cycles of sea level and precipitation and their anomalies are well-correlated. The majority of the seasonal sea level variations can be accounted for by the local steric property changes. The small difference between the dynamic height and sea level implies that the barotropic effects on sea level are small. The dynamic height and longshore flow respond to the annual hydrologic cycle for the Alaska south coast area. This provides an important mechanism through which the atmosphere can affect the local ocean circulation. The dynamic height beneath 100 m responds to wind stress changes through Ekman pumping and coastal divergences and convergences. Thus precipitation, runoff, and wind stress are all important to the coastal dynamics here. (Sims-ISWS)
W79-08237

SETTLING BEHAVIOR OF NATURAL AQUATIC PARTICULATES,

Chicago Univ., IL. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 2J.
W79-08238

ARSENIC SPECIATION IN SEAWATER AND INTERSTITIAL WATERS: THE INFLUENCE OF BIOLOGICAL-CHEMICAL INTERACTIONS ON THE CHEMISTRY OF A TRACE ELEMENT,

Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2K.
W79-08240

BIOLOGICAL PRODUCTION AND THE EXCHANGE OF OXYGEN AND CARBON DIOXIDE ACROSS THE SEA SURFACE IN STUART CHANNEL, BRITISH COLUMBIA,

Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 2K.
W79-08241

ORGANIC DETRITUS PARTICLES: INITIATION OF MOTION CRITERIA,

Clemson Univ., SC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-08243

ON THE MEAN CIRCULATION IN THE MID-ATLANTIC BIGHT,

Woods Hole Oceanographic Institution, MA.
R. C. Beardsley, and C. D. Winant.
Journal of Physical Oceanography, Vol. 9, No. 3, p 612-619, May 1979. 4 fig, 1 tab, 19 ref. NSF OCE 76-01813, OCE76-19494.

Descriptors: *Circulation, *Ocean circulation, *Atlantic Ocean, Oceans, Coasts, Winds, Wind pressure, Runoff, Salinity, Density, Model studies, Mathematical models, Computer models, Continental shelf, Water circulation, Currents(Water), Ocean currents, Oceanography, *Mid-Atlantic Bight.

Two possible mechanisms which may drive the observed mean alongshelf flow in the Mid-Atlantic Bight were described. Runoff from concentrated sources could conceivably force this flow; however, the one-layer homogeneous model results of Csanady, and Beardsley and Hart imply that the observed shelf flow is not driven by runoff alone. On the other hand, the Semtner and Mintz numerical model of the North Atlantic strongly suggests that the shelf circulation is just a boundary layer component of the ocean circulation and thus driven by the large-scale wind stress and heat flux distributions. This model result supports Csanady's conclusion that the physical mechanism which creates the alongshelf pressure gradient thought to drive the alongshelf flow must be of oceanic origin. (Sims-ISWS)
W79-08255

STRESS AND TIDAL CURRENT IN A WELL-MIXED ESTUARY,

New Hampshire Univ., Durham. Dept. of Mechanical Engineering.
M. R. Swift, R. Reichard, and B. Celikkol.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14682, p 785-799, July 1979. 5 fig, 1 tab, 9 ref, 3 append.

Descriptors: *Estuaries, *Tidal waters, *Currents(Water), *Stress, Model studies, Mathematical models, On-site investigations, Shear stress, Turbulence, Channels, Tides, Flow, Boundary layers, Reynolds number, Friction, Fluid friction, Hydraulics, Hydrodynamics, Oceanography, *Well-mixed estuaries.

A procedure for calculating the vertical shear stress distribution in tidal channels of well-mixed estuaries from current profile measurements was formulated. A linearized boundary layer form of the Navier-Stokes equation and eddy viscosity representation of Reynolds shear stress were used to determine the depth and time dependence of current velocity and stress. A lower (near bottom) boundary condition on stress was employed rather than the usual no-slip condition on velocity. A verification experiment was described in which the theoretical model was used to calculate stress from current profile data taken in a tidal channel over a half tidal cycle. The predicted stress was then compared with a direct independent measurement of Reynolds shear stress. It was shown that for a one-layer estuary model, best results are obtained using an eddy viscosity having a quadratic depth dependence. (Sims-ISWS)
W79-08261

STUDIES ON THE SEDIMENT OF ST. MARGARET'S BAY, NOVA SCOTIA,

Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
T. G. Hughes.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 5, p 529-536, May 1979. 5 fig, 2 tab, 25 ref.

Descriptors: *Bays, *Sediments, *Organic matter, *On-site investigations, *Canada, Particle size, Sampling, Testing procedures, Methodology, Analytical techniques, Cores, Mineralogy, Gravimetric techniques, Measurement, Distribution, *Nova Scotia, *St. Margaret's Bay(Nova Scotia), Organic carbon, Total organic carbon.

A detailed examination of the sediment in a small area of St. Margaret's Bay revealed it to be com-

posed of two main types of particles, mineral particles and particles of organic debris. Debris was also adsorbed onto the mineral particles. Particles generally had relatively low numbers of bacteria associated with them, indicating that most of the organic carbon in the sediment is refractory. Variation in size distribution of the component particles with depth in the sediment was found to be minimal, but a slight decrease in the proportion of debris particles was seen. Variation in size distribution along a transect was also limited, but where the mineral particles became coarser, the size range of the debris particles remained constant. The relative amount of debris particles along the transect varied little, but values for total organic carbon (by weight) changed dramatically. (Humphreys-ISWS)
W79-08267

PUGET SOUND CIRCULATION: FINAL REPORT FOR FY77-78,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
G. A. Cannon, N. P. Laird, and T. L. Keefer.
NOAA Technical Memorandum ERL MESA-40, February 1979. 60 p, 29 fig, 3 tab, 16 ref.

Descriptors: *Circulation, *Estuaries, Effluents, Water properties, Waste water disposal, Washington, *Puget Sound(WA), Estuarine circulation, Marine Ecosystems Analysis Program(MESA).

Physical oceanographic research in Puget Sound has focused on describing deep water flow through the main basin and on determining its principal driving mechanisms. Observations, however, have been made throughout the water column using moored current meters and shipboard STD surveys. The main experimental site has been located near the largest single wastewater discharge point in Puget Sound. Hence, some of the results should be applicable in determining physical factors influencing the transport and dispersions of effluents. Additional observations were made in 1977 in The Narrows and in Admiralty Inlet, the two major sills located at opposite ends of the main basin. Observations during winter near The Narrows and Vashon Island confirmed earlier hydraulic model data and showed a clockwise tidally averaged flow around Vashon Island. Observations during late summer to early fall in Admiralty Inlet showed new bottom water entering Puget Sound both when flood tides ranges did and did not exceed 3.5 m. (NOAA)
W79-08380

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION APPARATUS,
K. F. Ziehm, Jr.
U.S. Patent No. 4,138,293, 6 p, 7 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 249, February 6, 1979.

Descriptors: *Patents, *Desalination, *Desalination process, *Desalination apparatus, Separation techniques, Water purification, Solar radiation, Water vapor, Condensation.

Solar heat-absorbing metal members such as balls, rollers or a metal endless belt is utilized to initially absorb solar heat in a heating chamber. The metal members pass beneath a transparent cover and become heated through absorption of the solar radiation passing through the cover. These metal members with their latent heat then pass directly into a vaporizing chamber where they are sprayed with sea water or other salt or saline water. The latent heat causes essentially salt-free water to vaporize. The vapors are condensed by a condenser system such as condenser tubes through which pass cooler raw sea water or other readily available water. The condensed vapors are collected, thereby providing substantially pure water. After the metal members pass through the vaporizing chamber they are encrusted with the salts of the sea water and are immediately rinsed in a rinse tank which is supplied with warm rinse water coming from the condenser tubing. After such rinsing they are returned to the heating chamber for solar reheating and a repetition of the vaporizing and rinsing functions. (Sinha-OEIS)
W79-08227

FLOW CONTROL ALGORITHMS FOR YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Electric Power Branch.
For primary bibliographic entry see Field 8C.
W79-08356

STATUS OF THE YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Denver Federal Center.
L. A. Haugseth.
Desalination, Vol. 27, No. 3, p 157-174, Dec., 1978, 6 fig, 1 tab, 3 ref.

Descriptors: *Desalination, *Water treatment, *Desalination apparatus, *Desalination plants, Saline water systems, Treatment facilities, Colorado River, Mexican water treaty, Yuma desalting plant.

The current status of the Yuma Desalting Plant, located 7.4 km west of Yuma, Arizona, in response to the U.S. agreement to provide Mexico with water of a salinity of no more than 115 p/m greater than the salinity of Colorado River water arriving at the Imperial Dam, is summarized. Progress on the 4.21 m3/s membrane desalting plant, including site selection, equipment proposals, specifications for peripheral support equipment, the sludge disposal site, and the power source are discussed. Current plans calling for as many as 20 separate contracts to cover the plant have been slowed somewhat until a legal question concerning the procurement of equipment is decided upon by the General Accounting Office although a decision is expected shortly. (Tickes-Arizona)
W79-08377

3B. Water Yield Improvement

USE OF GROUND WATER FOR THE DEVELOPMENT OF RAJASTHAN DESERT,
Malviya Regional Engineering Coll., Jaipur (India). Dept. of Civil Engineering.
R. D. Verma.
Transactions of Indian Society of Desert Technology and University Center of Desert Studies, Vol. 2, No. 2, p 145-151, Dec. 1977, 4 tab, 7 ref.

Descriptors: *Groundwater resources, *Water transfer, *Water resources development, *Planning, Water balance, Groundwater availability, Groundwater recharge, Mathematical models, Alternate planning, Comprehensive planning, Future planning(Projected), Rajasthan Desert, India, Groundwater mining.

This paper reviews the progress being made in the development of groundwater resources in the region of the Indian Desert which encompases the western half of Rajasthan and extends over parts of Gujarat and Haryana. Although a scientific assessment of the surface and groundwater resources of this desert area have yet to be completed, the Central Water Board with the assistance of the United Nations Development Programme has recently made studies for the development of groundwater resources in Rajasthan with the following results and recommendations: (1) water level observations indicate some recharge due to precipitation, (2) water balance studies of selective basins within the region should be combined with reliable methods of scientific hydrology and mathematical optimization modelling to determine available water resources and formulate plans for optimal use. (3) Long term groundwater mining for the economic development of the desert areas suggest that water utilization be restricted to various uses, and (4) new surface water sources from the Narmada, Mahi, and Ganga Rivers should be developed for transferring water from these basins to the arid areas of Rajasthan. (Tickes-Arizona)
W79-08025

WATER HARVESTING PRACTICES FOR ARID AREAS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
T. N. Chaudhary, and S. S. Prihar.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 232-239, Dec 1977. 3 fig, 3 tab, 25 ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Runoff, *Water spreading, Arid climates, Water conservation, Water yield improvement, Surface runoff, Reservoir storage, Water storage, Seepage, Sedimentation, Rainfall disposition, Farm ponds, Irrigation water, Soil properties.

Water harvesting or the collection of runoff water from either treated or untreated land is discussed here in two categories: (1) runoff recycling where runoff is stored in a reservoir for supplemental irrigation, and (2) runoff farming where harvested water is stored in the soil itself. Runoff recycling systems involving the inducement and storage of runoff and supplemental irrigation are dependent upon the control of seepage, evaporation and sedimentation and some of the potential measures to achieve these objectives are discussed. Runoff farming, on the other hand, involves diversion of runoff from watersheds to cropped areas and is dependent upon rainfall pattern, land configuration, soil and crop characteristics and the ratio of catchment to cropped area. The requisites, advantages, designs and selected results of runoff farming systems are described. It is concluded that since system choice and design is site specific, intensive studies are needed to determine suitable techniques for different areas. (Tickes-Arizona)
W79-08032

PROSPECTS OF WATER HARVESTING AND ITS UTILIZATION IN SAND DUNE AREAS OF SOUTH-WEST HARYANA,
Haryana Agricultural Univ., Hissar (India). Dept. of Soils.
R. P. Agarwal, M. C Agarwal, K. Singh, and J. Nath.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 255-261, Dec 1977. 6 tab, 1 fig, 9 ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Runoff, *Sands, *Dunes, Arid climates, Water conservation, Water yield improvement, Water storage, Soil moisture, Groundwater, Agricultural production, Rainfall disposition, Infiltration, Desalination, India.

The prospects of water harvesting techniques for the semiarid sand dune regions of Southwest Haryana, India, are discussed. Although water harvesting techniques involving both the storage of water in the soil and runoff recycling have limited applicability in sand dune areas, an approach is suggested here for the utilization of water harvested as surplus groundwater to stabilize agricultural production in these areas. An analysis of the rainfall and soil characteristics of this region indicate that high infiltration, low moisture storage capacity, high evaporative demand and lack of intense rain showers to cause runoff make it necessary to seek additional means of supplying agricultural water to these deficient areas. Suggested techniques include the utilization of presently under-exploited groundwater resources, desalination, and more judicious use of soil water. (Tickes-Arizona)
W79-08033

NUMERICAL MODELLING OF ICEBERG TOWING FOR WATER SUPPLIES--A CASE STUDY,
Adelaide Univ. (Australia). Dept of Chemical Engineering.
For primary bibliographic entry see Field 2C.
W79-08120

WEATHER MODIFICATION ACTIVITIES IN NORTH DAKOTA, SOUTH DAKOTA, AND MINNESOTA FROM 1951 THROUGH 1976,
North Dakota Univ., Grand Forks.
M. R. Schock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 669, Price codes: A07 in paper copy, A01 in microfiche. Report No. UND 77-4, September 1977. 125 p, 26 fig, 26 tab, 124 ref, 1 append. 14-06-D-7581.

Descriptors: *Weather modification, *Cloud seeding, *Evaluation, History, Benefits, Technology, Statistics, Environmental effects, Feasibility, State governments, Local governments, North Dakota, South Dakota, Minnesota.

The impacts of the weather modification projects taking place over North Dakota, South Dakota, and Minnesota are assessed to provide information for the evaluation of future weather modification research and applied projects. This two-part study focuses on the administrative and technical designs of projects conducted from 1951 through 1976. Part 1 is an historical overview in which delivery techniques, environmental assessments, the feasibility of achieving benefits, project documentation, evaluation methods, decision processes and factors, and the roles of state and local governments in weather modification are discussed. The appendix to Part 1 contains a list of significant historical dates in weather modification. Selected available information about each project provided in Part 2 includes: the project operator, the project name or sponsor, the project operational period, the target area, project objective, seeding technique, and available references. (Davison-IPA)
W79-08153

1978 STATUS REPORT -- THE SIERRA COOPERATIVE PILOT PROJECT, PRECIPITATION MANAGEMENT RESEARCH IN THE SIERRA NEVADA,
Bureau of Reclamation, Denver, CO. Office of Atmospheric Resources Management.
E. R. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 430, Price codes: A04 in paper copy, A01 in microfiche. Status Report, April 1978. 70 p, 6 fig, 5 tab.

Descriptors: *Weather modification, *Cloud seeding, *Social aspects, *Artificial precipitation, Environmental effects, Social impact, Evaluation, Project planning, Project feasibility, Water management(Applied), Cloud physics, Sierra Cooperative Pilot Project, Project Skywater, Sierra Nevada, American River Basin.

The activities and cooperative efforts of Project Skywater personnel and contractors, Federal, State regional and local agencies, private sector organizations, and residents of the study area are reported to provide up-to-date information on the progress of the Sierra Cooperative Pilot Project (SCPP). The technical feasibility and social acceptability of precipitation enhancement as an alternative water resource management tool are discussed; Results of the 1976-77 winter study season and the 1977-78 season activities are discussed; future activity is previewed. In early 1976 a liquid-tank model using stratified liquid was designed to simulate wind patterns across the eastern side of the Sacramento Valley, over the Sierra Nevada, and on into Western Nevada. The model was used to study the manner in which seeding material moves under three different atmospheric conditions: a prestorm situation with a deep inversion in the atmosphere, during a storm situation, and a post-storm situation. Other activities of the 1976-77 season include: tracer and diffusion and cloud microphysical studies in the American River Basin, development of radar climatology for the Sierra Nevada, acoustic sounder observations, ground microphysics, a precipitation profile for the area from Sacramento to Truckee, California, and satellite observations and data collection. The project field office was established at Auburn. (Davison-IPA)
W79-08350

FINAL REPORT SIERRA COOPERATIVE PILOT PROJECT,
Aero Systems, Inc., Boulder, CO.
W. J. Carley, F. S. Solheim, E. X. Berry, and L. E. Liles.
Report prepared for Bureau of Reclamation, Denver, Colorado May 31, 1979. 82 p, 2 fig, 2 tab, 3 append.

Descriptors: *Cloud seeding, *Dry ice, Silver iodide, *Sierra Nevada Mountains, Snow management, Weather modification, Ice, Data storage and retrieval, Artificial precipitation, Rain, Chemistry of precipitation, Clouds, Cloud physics.

The performance of Aero Systems, Incorporated in the 1978-79 Sierra Cooperative Pilot Project (SCPP) is examined. The company provided an aircraft capable of seeding with dry ice and silver iodide flares and of measuring basic cloud physics parameters related to determining a cloud's seedability. Software was developed allowing data to be reduced on the University of Wyoming computer for review immediately after flight. Aero Systems also performed reduction and preliminary analysis of the seeder aircraft's airborne data. Key accomplishments under the contract were: excellent performance of aircraft and flight crew, encouraging and adopting the use of a short period randomization scheme to dramatically reduce learning time over the original scheduled randomizations, and the accurate targeting and locating of the seeded plumes to assist various cloud physics measurements of seeding effect. Observations and review of data tentatively suggest that cost effective operational cloud seeding may not be possible in the northern Sierra Nevada. (Schaefer-IPA)
W79-08358

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX F -- IRRIGATION.
Pacific Nothwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 758, Price codes: A08 in paper copy, A01 in microfiche. Chaired by the Bureau of Reclamation, 1969, 97 p, 53 tab, 5 fig, 25 maps, 20 photos.

Descriptors: *Water resources, *Water resources development, *Irrigation, *River basin development, *Water distribution(Applied), *Water sources, *Water demand, Oregon, Water law, Planning, Land use, Land resources, Irrigable land, Arable land, Land reclamation, Land classification, Water requirements, Water rights, Irrigated land, Irrigation effects, Irrigation practices, Irrigation programs, Irrigation water, Irrigation systems, Irrigation efficiency, Groundwater, Multipurpose projects, River basins, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources in the Willamette River Basin in Oregon. Appendix F - one of the functional appendices - relies upon supporting data contained in the 3 supporting appendices, A through C. Its objectives are to appraise present irrigation development, to outline irrigation potential, and to recommend irrigation development. Projections are given for the years 1980, 2000, and 2020. The present status of irrigation in the Basin is first reviewed by looking at present irrigation development through irrigated land, water sources, quality, rights and use, and the irrigation economy. Irrigation potential is assessed through land characteristics; problems are outlined. Future demands are projected using a study of the irrigation economy-farm types, crop yields, land use, livestock, and markets. Alternative means of satisfying demands are first outlined on a basin-wide scale and then presented for each of 11 subbasins. Since seasonal distribution of rainfall is a serious deterrent to optimum agricultural production, it is felt that further irrigation development is vital. This development is expected to increase in the next three decades and then to level off. Use of groundwater is projected, along with the development of new storage facilities. Consideration of redistributing present storage assignment is also suggested. A final recommendation calls for the strengthening and facilitation of enforcement of the state's water rights program. (See also W79-08433) (Zayac-NC)
W79-08439

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX H--MUNICIPAL AND INDUSTRIAL WATER SUPPLY.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 760, Price codes: A05 in paper copy, A01 in microfiche. Chaired by Federal Water Pollution Control Administration, 1969, 13 tab, 9 fig, 2 maps, 15 photos, 78 p.

Descriptors: *Water supply, *River basin development, *Water demand, *Water resources development, *Water supply development, *Water use, Oregon, Dependable supply, Groundwater resources, Hydrology, Low-flow augmentation, Potential water supply, Pumped storage, Reservoir operation, Storage requirements, Surface water availability, Water allocation(Policy), Water conservation, Water conveyance, Water delivery, Water costs, Water policy, Water requirements, *Water resources, Water sources, Watershed management, River basins, Planning, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix H - one of the functional appendices - is based on data contained in the 3 supporting appendices, A through C. Its scope limits projection of municipal and industrial water supply requirements to the years 1980, 2000, and 2020. Appraisal of the 1980 requirements includes consideration of quantity, quality, and seasonal variation of supply and demand; the needs identified are more immediate in nature and may be related to the development of a comprehensive plan for foreseeable developments. The long-range plans point toward the needs of the 11 major subareas of the basin. In assessing the basin's present status of water supply, water use, water quality, and water sources are studied. Water use is discussed through water service for each subbasin, seasonal distribution of demand and per capita use; water quantity is reviewed by looking at water treatment and the cost of water. A section on future demands looks at water use trends and projections and specific problems in storage reservations, source identification, watershed management, and growth of demand. Alternatives are presented and reviewed for each subbasin. The study concludes that, broadly construed, there will continue to be excess of total supplies over demand. However, problems may arise both in specific areas and due to changing social and technological conditions. Thus, the recommendations are that present-day policies and attitudes be reevaluated if available resources are to be used efficiently. Among those policies are the ones involved with development and conveyance of water supplies from mountain sources and the planning for combining and centralizing municipal supply systems. (See also W79-08433) (Zayac-NC)
W79-08441

3C. Use Of Water Of Impaired Quality

RECYCLING OF SEWAGE EFFLUENT BY SUGARCANE IRRIGATION: A POSTTREATMENT STUDY JULY 1977 TO JUNE 1978 PHASE II-B (PROGRESS REPORT),
Hawaii Univ., Honolulu. Water Resources Research Center.
L. S. Lau, R. H. F. Young, P. C. Loh, V. F. Bralts, and E. K. F. Liu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 014. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 121, October 1978. 59 p, 12 fig, 2 plates, 7 tab, 30 ref, 5 append.

Descriptors: *Waste water treatment, *Water reuse, Screening, Filtration, Chlorination, Activated sludge, Sugarcane, Hawaii, *Drip irrigation, Posttreatment, Mililani STP, Oahu.

A pilot tube farm has been installed at the Mililani Sewage Treatment Plant, O'ahu, Hawai'i, to study the necessary treatment of activated sludge effluent for drip irrigation. Four types of effluent will be processed: 100% effluent, 50% effluent diluted with 50% Waiahole Ditch water plus the 100% effluent and the 50% to 50% mix after a 3-day detention in reservoir storage. Efficacy of treatment will be determined by the rate of plugging of the holes in the drip irrigation tubes and the quality of the posttreated water. The present posttreatment system consists of two-stage pressure filtration: first through No. 3 anthracite, then through No. 11 crushed granite. Filtration rate is 0.001 36-0.002 7 m3/s/m2 (2-4 gpm/ft2). The filtrate is given chemical treatment by chlorine, bromine chloride, or chlorine dioxide at a dosage equivalent to a 10 mg/l chlorine residual at the end of the drip tube line The system and the dosages will be varied to a level that will yield least plugging. Both single-chamber and dual-chamber tubing will be tested. The tube farm is automated and is operated on a 24-hr day schedule, processing 100% effluent for 12 hr and 50 to 50% dilution for 12 hr. Backwash takes place as the end of the run. Mean values for the effluent and ditch water were respectively, suspended solids, 31 and 23 mg/l; total plate count, 3 and 30 organisms x 1000/ml; total coliform, 34 and 970 organisms/ml; and total organic carbon, 56 and 27 mg/l. The volatile suspended solids content was 90% for the effluent but only 30% for the ditch water. A reuse bibliography has been compiled. A hydraulics test stand facility has been developed to study the effects of plugging on the hydraulics of emitter flow in drip irrigation lateral lines.
W79-08198

SALT WATER FIRE FIGHTING SUPPLY NORMALLY EXCLUDING SALT WATER,
Phillips Petroleum Co., Bartlesville, OK. (Assignee).
E. E Slanker.
U.S. Patent No. 4,140,146, 4 p, 1 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 979, No. 3, p 873, February 20, 1979.

Descriptors: *Patents, *Seawater, Saline water, Impaired water use, Impaired water quality, Water tanks, Water supply, Firefighting.

The object of this invention is to provide a fire water system normally filled with fresh water to avoid corrosion due to salt water, and a switch-cover to a seawater or salt water supply will take place automatically while there is still in the system a plentiful supply of fresh water. A fresh-water tank or sump is positioned with respect to a salt water or seawater supply in a manner such that the level of fresh water is substantially higher than the highest expected level of the salt water. A salt water supply pipe is connected into the fresh water tank at a point well below the normal level of fresh water in the tank but at a point above the suction of at least one pump adapted to pump water for fighting fire. The seawater supply pipe is equipped with a flap or equivalent valve which is maintained closed by the hydrostatic head of the fresh water which is higher than that of the salt water at the flap valve. (Sinha-OEIS)
W79-08234

ENERGY AND WATER SUPPLY, ORANGE COUNTY, CALIFORNIA,
Orange County Water District, Fountain Valley, CA.
D G Argo.
Desalination, Vol. 25, No. 2, p 135-149, April 1978. 2 tab, 2 fig, 5 ref.

Descriptors: *Water conveyance, Hydrologic budget, *Energy budget, *Water reuse, *Water allocation(Policy), *Water distribution(Applied), Conveyance structures, Engineering structures, Hydraulic structures, Colorado River, Energy gradient, Planning, Water supply, Water management(Applied), California.

In the arid southwest, where water is transferred great distances from areas of surplus to areas of shortage, the availability of power to move water is as vital as the water itself. In California and particularly Southern California, the demand for water has exceeded the local supply almost from the beginning of the settlement of the land and water leaders have devised some of the most elaborate water conveyance systems in the world. The purpose of the present paper is to evaluate the energy requirements of all water sources available to the service area of the Orange County Water District in Southern California where 1.5 million people rely upon a complex water supply system composed of local groundwater and imported water from the Colorado River and from Northern California. The summary of the actual energy costs to deliver and supply Orange County with water from three alternative sources: The Colorado River, water factory 21, and the state water project indicates that wastewater management reclamation appears to hold the greatest promise. (Tickes-Arizona)
W79-08376

3E. Conservation In Industry

METHOD FOR DECONTAMINATING WASTE MATERIAL FROM CHROMIUM MINERAL PROCESSING BY WET TREATMENT WITH SULPHUR,
Stappani (Luigi) di Stappani (P.) and Co., Milan (Italy). (Assignee).
For primary bibliographic entry see Field 5D
W79-08214

3F. Conservation In Agriculture

UTILIZATION OF A PORTABLE SOLID STATE FURROW IRRIGATION VALVE CONTROLLER,
Nebraska Univ. Panhandle Station at Scottsbluff.
R. J. Edling, H. R. Duke, and M. L. Payne.
Paper No. 78-2546, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 13 p. 3 fig, 4 ref. ASAE, St Joseph, Michigan.

Descriptors: *Furrow irrigation, Valves, *Control systems, Automation, Instrumentation, Application equipment, Electronic equipment, Irrigation systems.

Research was conducted during the summers of 1977-1978 on an USDA-SEA controller to allow semi-automatic changing of furrow irrigation sets. Two types of control valves were used with the controller. After initial difficulties, satisfactory use was obtained with the controller and both types of valves. Additional work in an on-farm situation was advised before the controllers use is recommended. (Skogerboe-Colorado State)
W79-08001

VOLUMETRIC CONTROL FOR IRRIGATION AUTOMATION,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, M. L. Payne, and D. C. Kincaid.
Paper No. 78-2545, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, Chicago, Illinois, 8 p. 3 fig, 4 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Surface irrigation, Automatic control, *Control systems, Automation, Electronic equipment, Instrumentation, Irrigation programs, Irrigation systems.

A digital electronic controller was developed for use in surface irrigation automation. This controller has full random-multiplexing capabilities and is capable of integrating flow rates as measured through a nonlinear open channel flow measurement device. (Skogerboe-Colorado State)
W79-08004

RESPONSE OF CORN TO LIMITED IRRIGATION ON SANDY SOILS,
Nebraska Univ., North Platte. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2I.
W79-08008

EXPLICIT SPRINKLER IRRIGATION UNIFORMITY: EFFICIENCY MODEL,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R Walker.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR2, p 129-136, June 1979. 5 fig, 8 ref

Descriptors: *Irrigation efficiency, *Sprinkler irrigation, *Application methods, Mathematical models, Systems analysis, Equations, Evaluation, Performance, Yield reductions, Economics, Pattern uniformity, Soil moisture depletion.

The relationship between pattern uniformity and application efficiency under a sprinkler irrigation system in which the pattern is assumed to be normally distributed over an area of uniform soil moisture depletion is expressed mathematically. Empirical equations relating the pattern's coefficient of variation, the fraction of adequately irrigated area, and the ratio of the mean required depth are summarized. The mathematical model is an aid in evaluating the performance of a sprinkler irrigation system on the basis of potential yield reductions over inadequately watered areas, the economic trade-off between the system's water application uniformity and its cost, and the environmental impacts of excessive drainage. Given criteria for assessing a sprinkler irrigation system in the general sense, the model allows design and operation optimization under widely differing conditions. (Bell Graf-Cornell)
W79-08012

JOJOBA WATER-HARVESTING AGRISYSTEM EXPERIMENT, PAPAGO INDIAN RESERVATION, SELLS, ARIZONA,
Arizona Water Resources Research Center, Tucson.
C. B. Cluff.
Jojoba Happenings, No. 24, p 3-10, September 1978, 3 fig, 2 tab, 9 ref.

Descriptors: *Water harvesting, *Water yield improvement, *Surface sealing, *Crop response, Rainfall-runoff relationships, Water conservation, Asphalt, Paraffin wax, Sodium chloride, Jojoba, Agricultural production, Economic justification, Water storage, Detention reservoirs, Sealants.

Described here is an agrisystem established at Sells, Arizona, in 1974-75, to demonstrate how water harvesting techniques can be used to concentrate precipitation and enhance the growth and production of Jojoba. Three catchments treatments: (1) sodium chloride, (2) asphalt-plastic-asphalt chip (APAC), and (3) paraffin wax were applied to three 60 by 270 foot areas containing two 30 foot wide drainage catchments with a row of Jojoba plants in the center. Catchments which were constructed on a 10% slope, drain into three reservoirs to facilitate water storage and pump back irrigation during winter and spring to maximize bean production. Results have indicated that the salt treated catchments which effectively shed water and control weeds on the catchment slopes are good for raising jojoba while the APAC-treated catchments weathered well except in areas where the initial chip treatment was inadequate and in localized areas where runoff has eroded the chip cover. The wax treatment does not seem to be long lasting and little usual evidence remains of surviving wax after three years. A summary of these results together with a review of the growing economic potential of jojoba indicates that larger installations of Jojoba water-harvesting agrisystems are justified. (Tickes-Arizona)
W79-08014

GROWING OF PROCESSING-TOMATO PLANTS UNDER WATER-DEFICIENCY CONDITIONS: MULCHING WITH TRANSPARENT POLYETHYLENE.

Hebrew Univ., Rehovot (Israel). Faculty of Agriculture.
J. Rudich.
Scientia Horticulturae, Vol. 10, p 117-125, 1979. 5 tab, 12 ref.

Descriptors: *Consumptive use, *Tomatoes, *Crop response, *Soil-water-plant relationships, *Water requirements, *Soil moisture, Soil management, Soil treatment, Agronomy, Water utilization, Crop production, Moisture uptake, Mulching, Soil surfaces, Fertilization, Dryfarming, Agricultural production, Chemical composition, Plastics, Varieties.

Agricultural production in water-stressed arid regions is based on the ability to find the optimal way for the plant to utilize the limited water reserves accumulated in the soil. Summarized here are the results of 6 years of research conducted in the semiarid northern region of Israel to determine the optimal cultivars, population size, distance between rows, phosphorus fertilization, seeding time, and mulching materials for the production of tomatoes under dry-farming conditions. Data are presented from the last 2 years of experimentation which processing tomatoes (Lycopersicon esculentum Mill.) were cultivated without irrigation in ar area devoid of summer precipitation by a method which included mulching with transparent polyethylene and intensified phosphorus fertilization. A factorial experiment was designed consisting of 6 10M long by 1.3M wide randomized block replicats in which mulching was done with transparent polyethylene sheets of .03MM thickness, fertilization carried out by the split plot method, and fruit harvested in a single operation. With emphasis placed upon the soil mulching effects and the interaction of mulching with other agrotechnical practices within the growers' control, results indicated that under the dry cultivation methods tested fruit quality was superior with respect to total soluble solids (TSS 7-8 degrees BRIX) high acidity amounting to 0.5% total titrated acid and high viscosity. (Tickes-Arizona)
W79-08021

UTILIZATION OF DRIP IRRIGATION FOR DESERT CONDITIONS,
University of Agricultural Sciences, Bangalore (India). Dept. of Agricultural Engineering.
T. C. Channappa.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 177-181, Dec. 1977, 6 tab, 8 ref.

Descriptors: *Irrigation effects, *Environmental effects, *Drip irrigation, *Irrigation efficiency, *Soil-water-plant realtionships, *Irrigated systems, Agronomic crops, Evapotranspiration, Plant growth, Crop response, Irrigation design, Water requirements, Trickle irrigation, Saline soils, Saline waters, Agricultural production, Water utilization, Consumptive use, Soil moisture, Arid lands, Sprinkler irrigation, Vegetable crops, India.

Drip or trickle irrigation is a recently developed technique that has been shown to possess many advantages in arid agricultural regions with characteristically saline soils and waters and high evaporation rates. Described here are the results of several field experiments conducted by some of the agricultural universities and research centers in India to determine the comparative effect of: (1) sprinkler, furrow and drip irrigation techniques on musk melons, (2) sprinkler and drip irrigation on cucumbers, (3) irrigation waters of various qualities applied by sprinkler and by drip methods to tomatoes, (4) surface irrigation and drip irrigation on lady fingers, (5) drip and surface methods in the water utilization and yield of tomatoes and Bhendi, (6) a drip system and the traditional system of irrigating bananas and (7) drip irrigation on tomatoes for the agroclimatic conditions of Karnataka. Results indicated that under drip irrigation; (1) the soil ceases to be a factor in holding water between irrigations, (2) the continuous supply of water with the same salinity reduces the progressive concentration of salts and the reduction of soil moisture between irrigations brought about by conventional irrigation methods, and (3) there is no need for precise levelling, erosion is reduced, water distribution is more uniform and there is no surplus water at the end of furrows. It is concluded that drip irrigation is a technique which is particularly suited to arid and desert conditions. (Tickes-Arizona)
W79-08028

CALCULATION OF EVAPORATION DURING THE THREE STAGES OF SOIL DRYING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2D.
W79-08138

FLEXIBLE MULTILAYER TUBULAR STRUCTURE FOR IRRIGATION AND PROCESS FOR ITS PREPARATION,
Mitsui Petrochemical Industries Ltd., Tokyo (Japan). (Assignee).
N. Inoue, I. Furukawa, and T. Usami.
U.S. Patent No. 4,139,159, 11 p, 23 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 545, February 13, 1979.

Descriptors: *Patents, *Irrigation, *Subsurface irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Drip irrigation.

A plastic tubular irrigating structure is provided for agricultural and other irrigation systems. The structure comprises flexible outer layer of a thermoplastic synthetic resin tube having at least one continuous fin-like heat-sealed portion along its length and watering orifices; and a flexible inner layer as a filter of a water-permeable, water-insoluble sheet, preferably a nonwoven fibrous sheet, fixed partly to the inside of the outer layer. The inner layer is permeable to a larger amount of water than the outer layer. In the absence of water supply, the structure is a flattened tube, but upon supply of water, it assumes an expanded tubular shape. (Sinha-OEIS)
W79-08217

SYSTEM FOR AUTOMATIC FORWARD BOW ALIGNMENT ON WATER DRIVE PIVOT,
Heinzman Engineering, Inc., Grand Island, NE. (Assignee).
J. C. Groelz.
U.S. Patent No. 4,139,018, 9 p, 5 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 498, February 13, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Lateral conveyance structures, Irrigation practices, Irrigation efficiency, Application equipment.

An automatic forward bow alignment system permits alignment of the towers of a water drive pivot irrigator. The system has: a valve assembly associated with each of the towers of the irrigator for regulating movement of the tower in a direction of rotation of the irrigator; and a sensor provided on the irrigator for detecting alignment of each of the towers along a predetermined desired forward which the irrigator is to assume, and controlling the valve assembly of the towers as a function of alignment and misalignment of the towers with respect to one another. The valve assembly of each of the towers includes a pair of valves mounted on the irrigator; a reversing arrangement mounted on the irrigator and connected to the valves for selectively holding one of the valves closed and one of the valves open; and a linkage mounted on the irrigator and connected to the valves and to the sensor for closing the other open valve when the associated one of the towers moves ahead of the desired bow which the towers are to follow about their pivot. (Sinha-OEIS)
W79-08218

SOIL IRRIGATION SYSTEM,
Verdyol International A. G., Allschwill (Switzerland). (Assignee).
H. G. Lloyd.
U.S. Patent No. 4,140,421, 8 p, 20 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 3, p 968, February 20, 1979.

Descriptors: *Patents, *Irrigation systems, *Subsurface irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Distribution systems.

A soil irrigation system comprises subterranean distribution pipes for distributing water to overlying soil. Each pipe has a perforated upper wall whose outer surface is covered with water permeable means for preventing the overlying soil from fouling the perforations. The remaining wall structure of the pipe retains the water permeable means in its covering relationship. The water permeable means is a unitary layer of capillary material which, in addition to its antifouling function, aids in equilizing the outflow of water from all the performations of the pipe. The retaining means is integral with the upper wall and is provided with a pair of inwardly projecting cams which overlie and secure the unitary layer of capillary material. It is constructed to prevent any water flow laterally out of the unitary layer and the outflow of water is constrained to move only in an upward direction. (Sinha-OEIS)
W79-08235

INTERRELATIONS OF THE PHYSICAL PROPERTIES OF COPPICE DUNE AND VESICULAR DUNE INTERSPACE SOILS WITH GRASS SEEDLING EMERGENCE,
Texas A and M Univ., College Station. Dept. of Range Science; and Max C. Fleischmann Coll. of Agriculture, Reno NV. Renewable Natural Resources Div.
For primary bibliographic entry see Field 2G.
W79-08348

MORE AND BETTER USES COULD BE MADE OF BILLIONS OF GALLONS OF WATER BY IMPROVING IRRIGATION DELIVERY SYSTEMS: DEPARTMENT OF AGRICULTURE AND THE INTERIOR,
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 8A.
W79-08353

IRRIGATION OF LOWVELD SUGARCANE,
J. E. Lonsdale.
Rhodesia Science News, Vol. 10, No. 8, p 204-205, August 1976. 1 fig, 1 tab.

Descriptors: *Irrigation systems, *Sugarcane, *Furrow irrigation, Surface irrigation, Sugar crops, Irrigation operation and maintenance, Irrigation practices, Furrow drainage, Flush and trickle irrigation, Drip irrigation, Evaporation.

Experimental evidence suggests that the total water requirement of sugarcane is approximately 1,600 mm per annum. The effective rainfall of the southeastern Lowveld is 400 mm. The additional 1,200 must be supplied as irrigation; if application efficiency is 80%, this figure is increased to 1,500 mm. The young crop has lower water requirements; a pan factor of 0.5 is recommended until the crop has developed a 25% canopy. Thereafter, until a 50% canopy has developed, a pan factor of 0.7 is recommended. A variety of irrigation systems has been used in the Lowveld. In furrows, normally the water supply is shut off and the syphon pipes removed when the water reaches the end of the furrow. A better distribution has been obtained with the 'flush and trickle' method: soil is wetted by a large flush which is then reduced to a trickle when the water reaches the end of the furrow. Drip irrigation is being investigated and developed locally. Efficient drains which can remove excess water, and injurious salts are necessary to prevent the build up of salts in the soil. Drainage will also prevent build-up of underground water tables which reduce the oxygen available to sugarcane roots. Major technical changes are likely to occur within the furrow irrigation system as it continues to be the commonest and most important system in the Lowveld. More water saving measures are also predicted. (Schaefer-IPA)
W79-08361

THE SCHEDULING OF IRRIGATION,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
For primary bibliographic entry see Field 4B.
W79-08363

TECHNOLOGICAL SUCCESS, URBAN GROWTH, AND RURAL DEPOPULATION: THE MALLEE OF SOUTH AUSTRALIA,
Flinders Univ. of South Australia, Bedford Park.
R. L. Heathcote, and M. Williams.
Economic Geography, Vol. 53, No. 4, p 385-387, Oct 1977, 2 ref.

Descriptors: *Farm management, *Economic efficiency, *Regional analysis, *Community development, Wind erosion, Urbanization, Cost-benefit analysis, Productivity, Social aspects, Social impact, Droughts, Australia, Rural sociology, Desertification.

The history and efforts of one man's family to farm a 1200 hectare plot in South Australia is reviewed here in an attempt to illustrate the physical, economic, and social consequences of desertification. In an area which receives an average of 340 mm of annuals rainfall, this man, with the help of his wife and two sons, has had a continuous fight with drought and wind erosion for the last 50 years. Although this family has achieved a moderate degree of technological success, evidenced by its $100,000 investment in sophisticated farm machinery, they are eeking out only small profits from their crops and livestock. Facing the rising costs of needed seed, fertilizer and equipment and the ever-present dangers of drought and wind erosion, this family must now choose between migration, changing cropping patterns, or increasing their land holding. The growing isolation and deterioration of the communities in this and surrounding areas is adding yet another deterrent to the stability of this region. (Tickes-Arizona)
W79-08368

PRODUCTIVITY OF IRRIGATED TROPICAL GRASSES UNDER DIFFERENT CLIPPING FREQUENCIES IN THE SEMI-DESERT REGION OF THE SUDAN,
Khartoum Univ. (Sudan). Faculty of Agriculture.
A. E. Osman.
Journal of Range Management, Vol. 32, No. 3, p 182-185, May 1979. 3 tab, 13 ref.

Descriptors: *Irrigation effects, *Crop production, *Forage grasses, *Range grasses, *Crop response, *Cutting management, Pasture management, Agronomic crops, Feeds, Biochemistry, Sudan, Proteins.

In the semiarid region of Sudan where 300 mm of annual rainfall supports natural vegetation consisting mainly of annual grasses, irrigated pastures are a potential source of good quality reliable forage. Treating these grasses as an irrigated crop rather than as a weed, this study compares the persistence and productivity of 2 native and 5 introduced warm-season grasses under 3 frequencies of clipping when irrigation was adequate. All species of grasses, both native and introduced, were seeded on 2 x 5 m plots in April 1976, irrigated every week, cut to 14 cm on July 10, 1976 and subjected to 3 cutting frequencies; at 2, 4 and 6 week intervals. Results indicated that buffel grass, rhodes grass, bambasti panic grass and green panic grass produced generally higher yields than para grass, blue panic and switch grass with clipping at 3 and 6 week intervals during the summer resulting in greater total annual yields than clipping at 2 week intervals. Grasses clipped at 2 week intervals were, however, twice as high in crude protein percentage as those clipped at 6 week intervals. With switch grass, para grass and blue panic grass the least able to withstand clipping, it is concluded that buffel, green panic, bambasti panic and rhodes grasses harvested at 4 week intervals are the best choices for production of forage in irrigated pastures in semiarid Sudan. (Tickes-Arizona)
W79-08374

EFFECT OF NITROGEN RATES, MULCHING AND ANTITRANSPIRANTS ON WATER USE AND WATER USE EFFICIENCY OF BARLEY (CHORDEUM VULGARE L.) VARIETIES GROWN UNDER DRY LAND CONDITIONS,
Indian Agricultural Research Inst., New Delhi. Div. of Agronomy.
S. K. Agarwal, and D. E. Rajat.
Journal of Agricultural Science, Vol. 92, p 263-268, 1979, 3 fig, 18 ref.

Descriptors: *Evapotranspiration control, *Mulching, *Antitranspirants, *Evaporation control, *Barley, *Efficiencies, Crop response, Nitrogen compounds, Water conservation, Crop production, Water requirements, Foliar application, Sprays, Kaolin, India, Dry farming.

Described is a field experiment conducted at the Indian Agricultural Research Institute at New Delhi during the winter seasons of 1972-3 and 1973-4 to determine the effects of nitrogen rates, mulching, and foliar application of antitranspirants on the soil water use of varieties of barley. Carried out on a sandy loam soil with a water-holding capacity of about 150 mm/m soil depth, this experiment was laid out in a split plot design in which the effects of 0, 30, and 60 kg of nitrogen on Ratna and Vijaya varieties of barley were determined in main plots, and mulch and antitranspirant effects were measured in sub-plots of 10.8 x 2.3 M. A wheat straw mulch was applied uniformly between rows three weeks after sowing and Kaolin was sprayed on the foliage as a 6% water suspension 45 and 65 days after sowing. Sowing was done by hand plough in the 3rd week of October. Each treatment was replicated three times. Results indicated that although total water use was not significantly different under the various treatments, the straw mulch and Kaolin decreased evapotranspiration at tillering and pre-flowering stages, making more water available at the critical stages of grain formation. It is concluded that nitrogen, straw mulch, and Kaolin coating techniques increase the water use efficiency of barley under these conditions. (Tickes-Arizona)
W79-08378

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX F -- IRRIGATION.
Pacific Nothwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08439

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PROTECTION OF THE BANKS OF THE AMU-DAR'YA RIVER FROM DEYGISH BY HYDROMECHANICAL MEANS,
For primary bibliographic entry see Field 2J.
W79-08145

PROCEEDINGS OF A SEMINAR ON NON-STRUCTURAL FLOOD PLAIN MANAGEMENT MEASURES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W79-08173

ENVIRONMENTAL PLANNING FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON. PART II. URBAN DRAINAGE STUDY. APPENDIX C:STORM WATER MONITORING PROGRAM,
Army Engineer District, Seattle, WA. Seattle District.
For primary bibliographic entry see Field 2E.
W79-08181

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, NILES-MCDONALD-GIRARD-WEATHERSFIELD TOWNSHIP.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W79-08187

FLOOD PLAIN INFORMATION: MAHONING RIVER AND CRAB CREEK, MAHONING COUNTY, OHIO, YOUNGSTOWN-CAMPBELL-STRUTHERS-LOWELLVILLE,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W79-08188

FLOOD PLAIN INFORMATION: MAHONING RIVER, TRUMBULL COUNTY, OHIO, CITY OF WARREN-LEAVITTSBURG, WARREN AND HOWLAND TOWNSHIPS,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 2E.
W79-08189

SPECIAL FLOOD HAZARD INFORMATION REPORT: WALNUT CREEK, MANSFIELD, TEXAS,
Army District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-08190

SPECIAL FLOOD HAZARD INFORMATION REPORT: WHITE OAK CREEK, DIBOLL, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-08191

FLOOD HAZARD ANALYSES, CARIBOU STREAM, CITY OF CARIBOU, AROOSTOOK COUNTY, MAINE,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08192

FLOOD HAZARD ANALYSES: LITTLE OSSIPEE RIVER, TOWN OF LIMINGTON, MAINE - YORK COUNTY.
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08193

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWN OF SOUTH BERWICK, MAINE, YORK COUNTY,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08194

FLOOD HAZARD ANALYSES: GREAT WORKS RIVER, TOWNS OF NORTH BERWICK AND SANFORD, MAINE - YORK COUNTY,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-08195

MULTI-GOAL ANALYSIS OF A SHORT-RUN RESERVOIR OPERATION,
Milan Univ. (Italy). Inst. di Elettrotecnica ed Elettronica and Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
G. Ambrosino, G. Fronza, G. Guariso, and A Karlin.
Applied Mathematical Modelling, Vol. 3, No. 3, p 221-227, June 1979. 8 fig, 25 equ, 10 ref, 1 append.

Descriptors: *Multi-goal programming, *Reservoir operation, *Optimization, *Lakes, *Decision making, *Benefit maximization, *Flood minimization, *Algorithms, Reservoir storage, Reservoir releases, Downstream recreation, Water management(Applied), Methodology, Pareto-optimal alternatives, Search algorithm, Lake Maggiore(Italy), Equations, Mathematical models, Systems analysis, Water flow

Multi-goal mathematical programming is applied to a water resource management problem concerning the regulation of a reservoir which releases water to downstream users and has recreational activities located on its sides. Pointed out are the efficient tradeoffs to be considered when operating a lake with the two objectives of maximizing the payoff from releasing water downstream and minimizing floods on the lakesides. The Pareto-optimal alternatives are found by an efficient search algorithm without applying the standard generating techniques of multi-goal programming. Similar properties are expected to hold also in other reservoir short-term regulation problems where the operating policy has to consider both drought situations (such as low flows as water quality indexes and flood events). The application of the analysis to a real situation (a lake in Northern Italy) is given in detail. (Bell-Graf--Cornell)
W79-08206

RAKE DEVICE FOR REMOVING WEEDS FROM LAKES,
L. H. Thompson, and A. Goplen.
U.S. Patent No. 4,137,693, 6 p, 8 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 46, February 6, 1979.

Descriptors: *Patents, *Weeds, *Aquatic weeds, *Aquatic weed control, Equipment, Lakes, Rakes.

A portable frame is mounted on a beach adjacent to a lake. The frame has a reversible motor and a pair of drive wheels driven by the motor. A rake with an elongated handle is provided. The drive wheels of the frame are adapted to engage the handle of the rake to move it backward and forward powered by the motor. The rake has teeth which fold inward when the rake is moved forward into the lake along the lake floor and the teeth will remain upright when the rake is powered back out of the lake, so that the teeth will engage the weeds and will take or pull the weeds out of the bottom of the lake as the rake is powered back out of the lake. (Sinha-OEIS)
W79-08229

EFFECT OF THE SUWANNEE RIVER SILL ON OKEFENOKEE SWAMP WATER LEVEL,
Georgia Univ., Athens. Dept. of Zoology.
J. T. Finn, and E. J. Rykiel, Jr.
Water Resources Research, Vol. 15, No. 2, p 313-320, April 1979. 4 fig, 5 tab, 21 ref. OWRT A-060-GA(2), NSF DEB76-12292.

Descriptors: *Swamps, *Georgia, *Water levels, *Rivers, *Dams, Effects, Variability, Drainage, Spillways, Streamflow, Precipitation(Atmospheric), Evapotranspiration, Regression analysis, Vegetation, Nutrients, On-site investigations, Data processing, *Okefenokee Swamp(GA), *Suwannee River(GA), River sills, Swamp water levels.

An 11-cm increase in mean water level at the Camp Cornelia boat basin in Okefenokee Swamp is attributable to the Suwannee River sill. This increase represents about 45% of the average total increase after sill construction. The remaining 55% can be explained as natural variation in the hydrologic cycle. A reduction of about 18-30% of the normal variation in water level has occurred since sill construction. Apparent surface water gradients have been substantially altered, and the potential impact area may approach 28% of the total swamp area. Changes in hydroperiod and water level amplitude in the sill impact area may affect the floristic character of the Okefenokee Swamp over the long term. (Sims-ISWS)
W79-08339

INSTITUTIONAL CONSTRAINTS ON LAND MANAGEMENT FOR WATER RESOURCE PROTECTION IN URBAN AND SUBURBAN WATERSHEDS,
New York Univ., NY. Graduate School of Business Administration.
For primary bibliographic entry see Field 6E.
W79-08341

NITROGEN, PHOSPHORUS, ORGANIC CARBON, AND BIOCHEMICAL OXYGEN DEMAND IN FLORIDA SURFACE WATERS, 1972,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. I. Kaufman, and J. E. Dysart.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 229 Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-43, 1978. 33 p, 14 fig, 5 tab.

Descriptors: *Nitrogen, *Phosphorus, *Surface waters, *Florida, Baseline studies, Biochemical oxygen demand, Organic matter, Nutrients, Chemistry of precipitation, Water quality, Water quality standards, Histograms, Data collections, Water analysis, Sampling, Sites, Regional analysis, Organic carbon.

Water samples were collected during spring and autumn 1972 from about 100 surface-water sites in Florida. The samples were analyzed for the plant nutrients, nitrogen and phosphorus. In most waters, nitrogen concentrations are less than 2.0 milligrams per liter as nitrogen, and organic nitrogen is dominant. Median total nitrogen concentration for Florida surface waters is between 1.2 and 2.0 milligrams per liter as nitrogen. In samples from 85 percent of the sites, total nitrogen exceeded 0.6 milligrams per liter. Median total phosphorus concentration as phosphorus for Florida surface waters is between 0.05 and 0.1 milligrams per liter. The information will form a base useful to agencies concerned with setting concentration limits for nitrogen and phosphorus in industrial and sewage plant outfalls. (Woodard-USGS)
W79-08384

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: MAIN REPORT,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 745, Price codes: A08 in paper copy, A01 in microfiche. 1969, 155 p, 4 maps.

Descriptors: *Planning, *Water resources, *Land resources, *Programs, *Projects, *River basin development, *Willamette River(OR), Regional analysis, Oregon, Land development, Water resources development, Fish management, Natural resources, Wildlife management, Navigation, Water quality, Water supply, Power marketing, Cost analysis, Economy, Population, Environmental effects, Flood control, Water pollution control, River basins, Environmental management.

This volume is the Main Report of a study undertaken to plan for the proper development of water and related land resoucres of the Willamette River Basin in Oregon. This need is made critical because the population of the area is expected to triple by 2020. Problems addressed by the study are flood control and prevention, irrigation development, drainage and erosion control, fish management, municipal and industrial water supply, water quality control, recreational development, navigation and power needs. The plan consists of a number of elements which can be grouped into three categories: those projects and programs existing or assured; those early-action projects and programs needed in the next 10-15 years; and those long-range projects and programs which would meet needs developing from 1980 to 2020. First the Basin is described--its land, stream systems, vegetation, climate, and natural resources. The study area's economy by income, employment, and industries is discussed. Population, existing and projected, is summarized. Present resource use and development is then inventoried by studying storage development, functional purposes, and water mangement programs, including water rights and water use programs. Problems of flood control, irrigation, power, navigation, recreation, water quality and supply, fish and wildlife, watershed protection, and environmental considerations are summarized. The plan is next presented. Its formulation procedure is discussed, costs are enumerated, and specific plan elements reviewed. Eleven subbasins of the Willamette Basin and their plans are summarized. Suggestions for implementation are presented. (See also W79-08434 thru W79-08445) (Zayac-NC)
W79-08433

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX A--STUDY AREA.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4C.
W79-08434

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX B--HYDROLOGY,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 2A.
W79-08435

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX E--FLOOD CONTROL.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6F.
W79-08438

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX H--MUNICIPAL AND INDUSTRIAL WATER SUPPLY.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08441

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX K--RECREATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6B.
W79-08444

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 3, LOGAN AND CHOCTAW BAYOUS,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-08446

FLOOD PLAIN INFORMATION: CUYAHOGA RIVER, MANTUA AND HIRAM, PORTAGE COUNTY, OHIO,
Army Engineer District, Buffalo, NY.
For primary bibliographic entry see Field 2E.
W79-08447

FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER AND RIPPLE RIVER, AITKIN, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W79-08448

4B. Groundwater Management

ARTIFICIAL GROUNDWATER RECHARGE AND ITS RELEVANCE IN BRITAIN,
Water Research Centre, Medmenham (England). Medmenham Lab.
K. J. Edworthy, and R. A. Downing.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 2, p 151-172, March 1979. 9 fig, 1 tab, 51 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Water management(Applied), *On-site tests, Injection wells, Pit recharge, Foreign re-

search, On-site investigations, Reviews, Water quality, Design criteria, Irrigation, Recharge ponds, Recharge wells, Performance, Clogging, Water storage, *Great Britain.

The design criteria for artificial recharge works were reviewed, and the cost of incorporating recharge in water resource schemes in Britain was discussed. The conclusions were: (1) Artificial recharge experiments carried out in Britain over the last 10 years have confirmed that: (a) the technique is applicable in the main aquifers, (b) average recharge rates of between 0.3 and 0.5 m/d can be anticipated where lagoons are used to recharge aquifers such as the Permo-Triassic sandstones and the Lower Greensand: in the case of wells, recharge rates similar to abstraction rate are likely, and (c) the quality of a water is improved by recharge through an unfissured aquifer. (2) Studies with mathematical models have suggested that recharge of the Chalk where it crops out and is drained by perennial streams, should be feasible In many circumstances. (3) It has been shown theoretically that even a limited amount of recharge can make a significant difference to minimum storage levels in coastal aquifers. (4) Development of artificial recharge on a regional scale would in many cases cost between 8 p and 10 p/ cu m. (5) Maximum use of aquifer storage requires artificial recharge. (6) Artificial recharge is often introduced into water resource systems for reasons of water quality. The quality of the supply to consumers can be manipulated to maintain acceptable standards, even where the source of supply is periodically susceptible to contamination. The natural purification afforded by aquifers, the long residence time, and the mixing of different waters in aquifers all act as safeguards for supply. (Humphreys-ISWS)
W79-08266

TENSIOMETERS AND IRRIGATION SCHEDULING,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
F. C. Van Rooyen.
The Deciduous Fruit Grower, Vol. 27, No. 2, p 402-407, November 1977. 3 fig, 1 tab, 4 ref.

Descriptors: *Tensiometers, *Irrigation, *Soil-water-plant relationships, Soil water, Tension, Instrumentation, Irrigation efficiency, Irrigated land, Manometer, Pressure measuring instruments, Bourdon vacuum meter, Scheduling, Soil moisture, Soil moisture meters.

The practical aspects of the use of tensiometers in irrigation scheduling are examined. Tensiometers measure the relative wetness of the soil, and the two basic types, the mercury manometer and the Bourdon vacuum meter, both work on the same principles. A porous ceramic head is connected by a plastic tube to a manometer or vacuum meter. The system is filled with water and inserted into the soil. Water moves through pores of the head until equilibrium of tension is reached between the water in the head and in the surrounding soil. If the soil dries out further, tension increases in the instrument and is registered on the manometer or vacuum meter. When used correctly tensiometers are excellent and reliable instruments to be used in irrigation scheduling; however, often the user has a deficiency of knowledge regarding assembly, preparation, maintenance, and installation of the instrument. Assembly is usually detailed in users' manuals. The plastic tube must be completely filled with air-free water; the ceramic head must be saturated with water; the scale must be adjusted to a zero reading. Regular servicing is essential. Tensiometers should be installed in representative spots at each soil layer. Readings should be taken and recorded at least every second or third day depending on soil texture. (Schaefer-IPA)
W79-08362

THE SCHEDULING OF IRRIGATION,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
F. C. Van Rooyen.
The Deciduous Fruit Grower, Vol. 26, Part 10, p 384-391, October 1976. 3 fig, 1 tab.

Descriptors: *Scheduling, *Irrigation practices, *Irrigation efficiency, Soil water, Instrumentation, Tensiometers, Evaporation pans, Evapotranspiration, Soil moisture, Soil water movement, Soil-water-plant relationships, Irrigated land, Saturated soils, Soil moisture meters, Consumptive use.

The purposes and procedures for implementing irrigation scheduling are presented. Details are given for two techniques to measure water consumption by plants. Reasons for irrigation scheduling include increased crop yields, the ever-growing shortage of water, present ineffective irrigation techniques including over-irrigation, and the desire to reclaim the large amounts of capital invested in irrigation schemes. Most agricultural crops cannot absorb any water at all through the roots when soil moisture tension reaches 220 pounds per sq inch. This point is known as the permanent wilting point (PWP) because the result of PWP is permanent damage caused by wilting. The point at which soil is saturated (adding more water will only cause drainage) is called the field-water capacity (FWC or FC) and differs from soil to soil. The basis of good irrigation is the balance between the consumptive use of water by the plant (CU) and the sum of irrigation plus rainfall. The Class-A evaporation pan measures CU by using the principle of evapotranspiration (ET), a combination of evaporation (E) and transpiration (T). The evaporation from the pan multiplied by a crop factor is equal to the soil ET or CU. The tensiometer is a direct-reading instrument for determining soil moisture tension in situ. This instrument must be placed in the ground so that it is representative of the relevant soil types. (Schaefer-IPA)
W79-08363

AVAILABILITY OF ADDITIONAL GROUND-WATER SUPPLIES IN THE PASCAGOULA AREA, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Mississippi Research and Development Center, 1978. 32 p, 11 fig, 3 tab, 16 ref.

Descriptors: *Groundwater resources, *Water quality, *Aquifer characteristics, *Mississippi, *Groundwater availability, Water supply, Chemical analysis, Water wells, Pumping, Water yield, Drawdown, Water levels, Water utilization, Saline water intrusion, Hydrogeology, Projections, Water demand, *Pascagoula area(Miss).

During 1960-77, ground-water pumping for municipal supply and industrial use in the Pascagoula area, Mississippi, approximately doubled to about 22 Mgal/d (million gallons per day). The freshwater aquifers, approximate depths to aquifers, and the ground water used in 1977 were as follows: Citronelle Formation, depth 200 feet, used less than 1 Mgal/d; Graham Ferry Formation, depth 350 feet, used 12 Mgal/d; 600-foot sand of the Pascagoula Formation, used 2 Mgal/d; 800-foot sand of the Pascagoula Formation, used 7 Mgal/d. The water levels in all wells in the area were above NGVD (National Geodetic Vertical Datum) in 1939, and most water levels were still above NGVD in 1960. In 1977, however, water levels in some wells in the Graham Ferry and the Pascagoula Formations were more than 100 feet below NGVD. In some areas the Citronelle probably could yield more than 8 Mgal/d to well fields; however, a high stress on the Citronelle aquifer probably would cause saltwater intrusion from nearby surface water bodies. Transmissivities and available water levels would allow about twice as much pumping from the Pascagoula and Graham Ferry Formations in the Pascagoula area as the 21-Mgal/d pumping rate in 1977. However, the increased stresses on the aquifers would increase the rate of movement of brackish water northwestward and probably would cause the water in some wells in the south and east parts of Pascagoula to become brackish. (Woodard-USGS)
W79-08387

COMPUTER MODELING OF GROUND-WATER AVAILABILITY IN THE POOTATUCK RIVER VALLEY, NEWTOWN, CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08393

4C. Effects On Water Of Man's Non-Water Activities

ENVIRONMENTAL PLANNING FOR THE METROPOLITAN AREA CEDAR-GREEN RIVER BASINS, WASHINGTON. PART II. URBAN DRAINAGE STUDY. APPENDIX C:STORM WATER MONITORING PROGRAM,
Army Engineer District, Seattle, WA. Seattle District.
For primary bibliographic entry see Field 2E.
W79-08181

PROGRESS REPORT ON THE BLACK MESA, ARIZONA, GROUND-WATER MONITORING PROGRAM,
Geological Survey, Flafstaff, AZ. Water Resources Div.
G. W. Levings.
In: Proceedings of the 2d International Technical Conference on Slurry Transportation, Las Vegas, Nevada, March 2-4, 1977. Slurry Transport Association, Washington, District of Columbia, p 94-96, 1977. 3 fig.

Descriptors: *Coal mines, *Strip mines, *Slurries, *Pipelines, *Transportation, Water demand, Groundwater, Aquifers, Withdrawal, Drawdown, Water levels, Potentiometric level, Water supply, Water quality, Monitoring, *Navajo Sandstone aquifer, *Black Mesa(Ariz).

Black Mesa is in northeastern Arizona on the Navajo and Hopi Indian Reservations. In 1970, a coal company began a 35-year project to strip mine approximately 400 million tons of coal from the Wepo Formation of the Mesa Verde Group of Late Cretaceous age. About 150 million tons will be delivered to the Mohave Generating Station near Bullhead City, Arizona, via a 273-mile-long slurry pipeline and the remainder will be transported by rail. An average of 3,200 acre-feet of water per year will be pumped from the Navajo Sandstone aquifer for the slurry pipeline and associated mining operations. The Navajo Sandstone of Late Triassic and Jurassic age is the only aquifer in the area capable of yielding more than 50 gallons per minute of good quality water, and is the source of most of the water used by communities and schools on or around the mesa. Concern has been expressed that water withdrawn for the slurry pipeline and mining operations will lower the potentiometric surface in the Navajo Sandstone aquifer. This could adversely effect the water supplies in the area. The U.S. Geological Survey began a project in 1971 that consists of four activities: water-level monitoring in the Navajo Sandstone aquifer; water-level monitoring in aquifers other than the Navajo Sandstone; monitoring of pumpage from the Navajo Sandstone; and monitoring of water-quality conditions in the Navajo Sandstone. (Woodard-USGS)
W79-08400

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 351, Price codes: A02 in paper copy, A01 in microfiche. March, 1971. 21 p

Descriptors: *Water quality control, *Thermal pollution, *Temperature control, Water pollution, Aquatic animals, Water pollution control, Industries, Biological communities, Agriculture, Potable water.

The water quality standards program is directed by the federal Environmental Protection Agency, which has responsibility for approving state-adopt-

ed standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance. The first nationwide strategy for water quality management standards contain four major elements: (1) the use (recreational, drinking, fish and wildlife propogational, industrial or agricultural) to be made of the interstate water; (2) criteria to protect those uses; (3) implementation plans (for needed industrial-municipal waste treatment improvements) and enforcement plans; and (4) an antidegradation statement to protect existing high quality waters. State-adopted temperature standards are surveyed. Temperature standards are set to control thermal pollution, or the amount of heated wastes discharged into water. Thermal pollution creates adverse conditions for aquatic life, accelerates biological in the streams which reduces the dissolved oxygen content of the water, increases the growth of aquatic plants which contributes to taste and odor problems, or otherwise makes the water less suitable for fish and wildlife, domestic, industrial, and recreational uses. (Vloedman-Florida)
W79-08425

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX A--STUDY AREA.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 746, Price codes: A07 in paper copy, A01 in microfiche. Chaired by Oregon State Water Resources Board, 1969. 103 p, 19 tab, 6 fig, 5 maps, 42 photos.

Descriptors: *Water resources, *Land resources, *Planning, *Natural resources, *Physical properties, *Resources, *Programs, *Land use, *Water rights, *River basin development, *Willamette River(OR), *Resource utilization, Oregon, Climate, Economy, Soils, Geology, Populations, Institutions, Legal aspects, Water law, Water rights, Surface water, Groundwater, Governments, Agriculture, Minerals, Forest, Laws, River basins, Physiography.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette Basin in Oregon. Appendix A, along with Appendices B and C, provides supporting data for the functional appendices D through L. First studied in detail are the physical characteristics of the basin. Included are reviews of climate, physiography, geology, soils, and social and economic development such as population distribution, employment, transportation, utilities and institutions. Resources are next inventoried. Water is studied by looking at surface and ground water supply and water use; fish and wildlife are discussed, minerals--including nonmetals, metals and fuels--are outlined; the uses of forests and forest lands are described; agriculture is reviewed; and recreational resources are enumerated. Finally, resource utilization objectives and programs are presented. This section describes goals and objectives for both land and water and discusses State laws, policies, and programs, including statute and case law reviews, water rights and the role of governmental agencies. (See also W79-08433) (Zayac--NC)
W79-08434

GRAZING ON WETLAND MEADOWS,
Georgia Univ., Brunswick. Marine Resources Extension Center.
R. J. Reimold.
In: Estuarine Processes, Volume I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y. 1976. p 219-225. 35 ref.

Descriptors: *Grazing, *Wetlands, *Effects, Marshes, Agriculture, Soils, Compaction, Rooted aquatic plants, Primary productivity, Invertebrates, Detritus, Succession.

Although marshlands were once visualized a potentially productive pasture through ditching, diking and draining, 'cat-clay' problems associated with large quantities of organic matter and anaerobic conditions result in complex polysulfides that, when oxidized, produce extremely acidic soil conditions detrimental to all vegetative growth. The extent of substrate compaction and the species of vegetation determine the feasibility of grazing a wetland area. In grazed Spartina marshes, net primary production was 50% of the production occurring on ungrazed sites. Grazing also had a significant negative impact on the macro-invertebrate populations and resulted in differences in plant successional trends. Grazing also significantly reduced detritus production. Marshes appear to recover from grazing once it is terminated. (Stihler-Mass)
W79-08469

THE EFFECTS OF FIRE ON THE ECOLOGY OF THE BOREAL FOREST, WITH PARTICULAR REFERENCE TO THE CANADIAN NORTH: A REVIEW AND SELECTED BIBLIOGRAPHY,
Canadian Wildlife Service, Delta (British Columbia).
J. P. Kelsall, E. S. Telfer, and T. D. Wright.
Occasional Paper Number 32. 1977. 58 p, 1 fig, 199 ref, 1 append.

Descriptors: *Burning, *Marsh management, *Canada, Wetlands, Wildlife habitat, Forest management, Productivity, Forests, Bogs, Peat, Wildlife.

This review analyzes literature relevant to the effects of fire on the Boreal Forest, and on its related wildlife resources, with particular reference to the Canadian North. Fire rids marshes of dead grass, sedges, and shrubs and makes new shoots available to cattle, furbearers, and waterfowl. Burning releases nutrients from organic litter, usually potassium, calcium, phosphorus, magnesium, and chlorides. The productivity of several major wetland areas in interior Alaska seems to be maintained by two natural factors--periodic flooding and periodic fires. Burning keeps marshes at a subclimax state that is most productive of food such as Scirpus spp. (Steiner-Mass)
W79-08483

WETLANDS, DRAINAGE AND LEISURE,
For primary bibliographic entry see Field 6G.
W79-08489

WILDLIFE HABITAT AS AN INTEGRAL COMPONENT OF A PLANNED UNIT DEVELOPMENT,
Carlozzi, Sinton, and Vilkitis, Inc., Amherst, MA.
J. R. Vilkitis.
Urban Ecology, Vol. 3, No. 2, p 171-187, June, 1978. 8 fig, 1 tab, 3 ref.

Descriptors: *Comprehensive planning, *Bioindicators, Environmental effects, Planning, Long-term planning, Indicators, Analysis, Habitats, Landscaping, Aesthetics, Habitat improvement, Monitoring, Wetlands, Swamps.

A planned unit development (PUD) for 8800 single-family and multiple dwellings was designed and is being implemented to be consistent with the biological resources of the site and ecological parameters set by land form and function. The underlying philosophy was to enhance and maintain natural habitat for wildlife and to improve the aesthetic character of the landscape through diversifying open space, plantings, and waterways. Upon completion of landscape renovation, none of the indigenous species of wildlife known to inhabit the site were displaced due to the total destruction of their habitat. Of the four types of wildlife environments identified (forest edge, wetlands, savanna, and swamp forest) three were enhanced; the swamp forest was not altered and was set aside as a natural preserve. The uplands and improved pasture (savanna) were the areas chosen for development. (Bollinger-Mass)
W79-08490

THE INFLUENCE OF PREHISTORIC CULTURES UPON THE INITIATION AND SPREAD OF BLANKET BOG IN UPLAND WALES,
Kings Coll., London (England). Dept. of Botany.
P. D. Moore.
Nature, Vol. 241, No. 5388, p 350-353, February 2, 1973. 6 fig, 3 tab, 14 ref.

Descriptors: *Bogs, *Grazing, *Lumbering, *Effects, Wetlands, Aquatic plants, Forests, Wales.

Spread of upland peat bogs and the consequent demise of former woodlands is usually attributed to climatic changes; however, the early human activities of woodland clearance and stock grazing may have hastened this vegetational regression. This hypothesis is supported by pollen data from a shallow peat near Barmouth in Merioneth, Wales. (Stihler-Mass)
W79-08499

4D. Watershed Protection

IMPACT OF VARIOUS RANGE IMPROVEMENT PRACTICES ON WATERSHED PROTECTIVE COVER AND ANNUAL PRODUCTION WITHIN THE COLORADO RIVER BASIN,
Utah State Univ., Logan.
I. K. Hessary, and G. F. Gifford.
Journal of Range Management, Vol. 32, No. 2, p 134-140, March, 1979, 10 fig, 6 ref.

Descriptors: *Land clearing, *Watershed management, *Range management, *Bush control, *Productivity, *Chemical analysis, *Pollutant identification, Pasture management, Revegetation, Water conservation, Hydrologic systems, Dissolved solids, Environmental effects, Soil salinity, Water salinity, Infiltration, Runoff, Rainfall-runoff relationships, Gully plugs, Contour furrows, Plant communities, Chaining, Sagebrush, Vegetation effects, Colorado River Basin, Juniper trees, Pinyon pine trees.

The Upper and Lower Colorado River Basins are contributing to an increase in salinity in the Colorado River. Since chemical constituents are an integral part of the hydrologic system, studies have been made of various range improvement practices in Colorado, Utah, New Mexico, and Arizona, in an effort to determine the impact of such treatments on salinity as gully plugs, contour furrowing, pitting, pinyon-juniper chaining, and various sagebrush control treatments. Comparisons of treated vs. untreated sites provide data on the relative success of these various practices on watershed cover and annual production: (1) 33 percent of the contour furrowed sites had significant increases in annual production, (2) annual production under pinyon-juniper chaining increased on a variety of soil types, (3) pitting on clay and sandy clay loam showed no increase in annual production, but rather a significant reduction in the clay soils, and (4) less than 50 percent of the various sagebrush treatments showed an increase, with plowing the least successful. It is hoped that the practical application of range improvement practices will lead to land management programs that will influence infiltration and surface runoff, thus helping reduce the diffuse salt production from wildland watersheds. (Tickes-Arizona)
W79-08018

PREDICTION OF SEDIMENT BASIN PERFORMANCE,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
A. D. Ward, C. T. Haan, and B. J. Barfield.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 1, p 126-136, January-February 1979. 16 fig, 1 tab, 17 ref, 1 append. OWRT B-046-KY(5). 14-34-0001-6081.

Descriptors: *Sediment control, *Sediments, *Basins, *Model studies, Mathematical models, Erosion, Construction, Strip mines, Particle size, Runoff, Legislation, Hydrographs, Settling basins, Trap efficiency, Discharge(Water), Water pollution. Water pollution control, Sediment basins.

Public Law 92-500 requires the control and reduction of point and nonpoint pollution to meet the 1983 water quality standards. Current legislation in several states requires the use of sediment detention basins to control pollution from strip mining and construction activities. It is envisaged that sediment basins may be employed successfully to control the nonpoint pollution associated with agriculture and silviculture. This paper presented a mathematical model for describing the sedimentation characteristics of detention basins. Using data generated by the model, the significance of the factors determining sediment deposition in estimating basin trap efficiency and peak effluent sediment concentrations was analyzed. Regression equations were presented for estimating trap efficiency and peak effluent sediment concentrations from basins equipped with either a perforated riser or a drop inlet riser. The effects of selective withdrawal from the basin were studied as well as the effect of sediment accumulations in the basin on the trap efficiency. The model was tested in simulation studies on several actual basins and appeared to give a good estimate of measured trap efficiencies. (Sims-ISWS)
W79-08337

WATER IN THE DAKOTA FORMATION, HODGEMAN AND NORTHERN FORD COUNTIES, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
D. H. Lobmeyer, and E. C. Weakly.
Kansas Geological Survey Irrigation Series 5, 1979. 41 p, 13 fig, 6 tab, 37 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water yield, *Water quality, *Kansas, Water wells, Withdrawal, Water supply, Municipal water, Irrigation wells, Hydrogeology, Water levels, Groundwater recharge, Water analysis, Chemical analysis, *Dakota formation, *Hodgeman County(Kans), *Ford County(Kans).

The water-yielding sandstone beds of the Dakota Formation in Hodgeman and northern Ford Counties, Kans., differ greatly in thickness, extent, and cementation. Wells in the Dakota commonly yield an adequate supply of water for domestic and stock use. Locally, municipal and irrigation wells obtain 100 to 2,000 gallons per minute from thick, loosely cemented sandstone beds. The annual pumpage from irrigation wells in the area ranges between about 7,700 and 15,000 acre-feet. The sandstone aquifers are recharged by water from overlying unconsolidated aquifers and by subsurface inflow from the south and west. Natural discharge is mainly by seeps and springs in the outcrop area along the Pawnee River and its tributaries. Water in the sandstone beds contains from 300 to 1,400 milligrams per liter dissolved solids, has a medium to very high salinity hazard, and has a low to very high sodium hazard. (Woodard-USGS)
W79-08396

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: MAIN REPORT,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4A.
W79-08433

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX G- LAND MEASURES AND WATERSHED PROTECTION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 759, Price codes: A14 in paper copy, A01 in microfiche. Chaired by Soil Conservation Service, 1969. 267 p, 1 addendum, 47 tab, 18 maps, 4 fig.

Descriptors: *Agriculture, *Land management, *Forestry, *Watershed management, *Watershed protection, *River basin development, Oregon, Agricultural watersheds, Agricultural runoff, Agricultural engineering, Land reclamation, Land development, Land resources, Soil conservation, Demonstration watersheds, Crops, Farm management, Land classification, Rural areas, Forest management, Erosion control, Carrying capacity, Forest soils, Sediment control, Forest watersheds, Watersheds(Basins), Forests, River basins, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix G, one of the functional appendices, is based in part on data contained in the 3 supporting appendices, A through C. The general goal is to modify land and water resource use to avoid impairment of the environment and to repair damage already done. Specifically involved are the prevention of excessive erosion, control of storm and sediment damage, and improvement of quality and quantity of water runoff. The appendix identifies measures and programs intended to insure the maintenance or enhancement of the agriculture and forestry environment; that the resource base (soil, water, vegetation) is capable of producing required outputs and that future demands on the resource base can be met. Present status of both agriculture and forestry is assessed. With agriculture, the land capability classification system is described, land use is inventoried and land and water related problems are discussed. In forestry, the characteristics of various forest areas are described, both by zone and for each of 11 subbasins. Forest land disturbances are reviewed, watershed management programs assessed, and forestry problems presented. Future demands on agriculture are studied through land use adjustments, rural land use and development, and possible land measures. Future demands on forestry are reviewed by studying forest land use as related to water and probable future problems--physical, economic and social, and institutional. Management concepts, ongoing programs and research needs are described for agriculture; basinwide alternatives are presented for forestry. (Zayac-NC)
W79-08440

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

MERCURY CONCENTRATIONS IN THREE SPECIES OF TUNAS COLLECTED FROM VARIOUS OCEANIC WATERS,
National Marine Fisheries Service, Milford, CT Experimental Biological Investigations.
R. A. Greig, and J. Krzynowek
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 120-127, 1979. 4 tab, 11 ref.

Descriptors: *Mercury, *Tissue analysis, *Bioaccumulation, *Tuna, *Albacore, *Skipjack, *Yellowfin, Chemical analysis, Commercial fishing, Atlantic Ocean, Pacific Ocean, Indian Ocean, Heavy metals, Marine fish, Path of pollutants, Size, Hawaii, Commercial fish.

Frozen tuna were sampled at dockside holding facilities of commercial fishing operations. Both muscle and liner samples were analyzed for total mercury concentration. Tissue mercury levels for three species from the Pacific, Atlantic and Indian Oceans ranged from 0.033 to 0.707 ppm. Attempts to attribute varying levels to specific geographical regions were unsuccessful. Mercury concentrations did vary as a function of length of tuna for albacore and skipjack (from Hawaii). A significant correlation was not found in skipjack from the eastern Atlantic. (Deal-E1S)
W79-08035

RELIABILITY OF AQUATIC INSECTS VERSUS WATER SAMPLES AS MEASURES OF AQUATIC LEAD POLLUTION,
Colorado Div. of Wildlife, Montrose.
R. B. Nehring, R. Nisson, and G. Minasian.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 103-108, 1979. 3 fig, 4 tab, 4 ref.

Descriptors: *Analytical techniques, *Lead, *Aquatic insects, *Bioconcentration, *Tissue analysis, *Iran, Chalus River, Dptera, Mayflies, Stoneflies, Chemical analysis, Spectrophotometry, Heavy metals, Path of pollutants, Water chemistry, Bottom sediments, Water pollution effects.

The purposes of the study were to: (1) evaluate the accuracy of the concentration factor method in determining the amount of lead pollution in the Chalus River (Iran), and (2) determine if several orders of aquatic insects would give repeatable results comparable to water sample analysis by flame atomic absorption spectrophotometry. Initial laboratory experiments indicated that the mechanism of lead uptake and loss varied with the type of exposure, making field determination of concentration factors essential. Subsequently, concentration factors were determined for six groups of aquatic insects. These concentration factors were used to estimate lead levels in the stream during subscquent sampling. Estimated stream lead levels and those determined by spectrophotometry rarely differed by more than 0.1 mg/L. (Deal-E1S)
W79-08036

FATE AND EFFECTS OF CADMIUM IN AN EXPERIMENTAL MARINE ECOSYSTEM,
Biologische Anstalt Helgoland, Hamburg (Germany, F. R.).
Dethlefsen V. von Westernhagen, H. Rosenthal, G. Furstenberg, and J. Klinckmann.
Helgolander wissenschaftliche Meeresuntersuchungen, Vol. 31, p 471-484, 1978. 4 fig, 1 tab, 33 ref.

Descriptors: *Cadmium, *Mussels, *Toxicity, *Bioaccumulation, *Tissue analysis, *Plaice, Ecosystems, Aquaria, Filters, Chemical analysis, Path of pollutants, Growth rates, Biomdicators, Fish physiology, Animal metabolism, Sludge, Water quality, Water chemistry, Metals, Commercial fish, Commercial shellfish.

Two recirculated marine seawater systems were used for the study on cadmium accumulation of biological filter sludge, by the mussel and the plaice for a period of up to 300 days. In the contaminated system Cd concentrations varied from 2.5 to 7.0 microgram/l with a mean of 4.6 + or - microgram/l (control: 1.04 + or - 0.46 microgram/l). Accumulation of Cd by the filter sludge from the control system as well as from the contaminated system was significant. Accumulation of Cd by M. edulis both in the control and in the contaminated system was considerable. After 163 days of exposure the whole body burden of mussels rose from 0.3 ng Cd/mg dry wt to around 10 ng Cd/mg dry wt in the controls and to 70 ng Cd/mg dry wt in the contaminated systems. Accumulation of Cd by P. platessa was analysed in backbone, fins, gills, liver, muscle (fillet), otolith and skin (dorsal and ventral) over a period of 280 days. Elevated Cd contents of livers from control specimens were noticed after 200 days and reached 1 75 ng Cd/mg dry wt in liver. There was considerable accumulation in the liver (maximum values: 3.0 ng Cd/mg dry wt) and gills (6.0 ng Cd/mg dry wt) of specimens from the contaminated system, Cd contents of plaice exposed for identical periods of time were very variable. Growth of plaice living in the contaminated system was at times significantly slower than that of the control group. Of the three biological objects tested-filter sludge, M. edulis, P platessa-the mussel seemed to be the most sensitive indicator of elevated Cd-concentrations, while the reaction of the plaice was slow and less distinct. (Deal-E1S)
W79-08037

DETERMINATION OF THE ABSORPTION OF CR+6 AND CR+3 IN AN ALGAL CULTURE OF CHLORELLA PYRENOIDOSA USING 51CR,
Roskilde Univ Center (Denmark). Inst for Environment, Technology and Society.
H. Schroll.
Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 721-724, 1978. 1 tab, 3 ref

Descriptors: *Chlorella, *Chromium, *Absorption, *Bioaccumulation, Cytological studies, Aquatic algae, Radioactivity techniques, Tracers, Chemical analysis, Path of pollutants, Chlorophyta, Growth rates, Ions.

The purpose of this experiment was to determine if Cr(+6) and Cr(+6) would be equally absorbed in a green algae culture of Chlorella pyrenoidosa when Cr-51 was used as a tracer. Identical Chlorella pyrenoidosa cultures were exposed to either Cr(+6) or Cr(+3) and analyzed after 3, 21 and 32 hours. Cr(+3) concentrations in the algae increased with each time interval while Cr(+6) levels decreased. From this it was concluded that Cr(+6) had an inhibiting effect on growth while Cr(+3) did not. (Deal-EIS)
W79-08038

INVESTIGATION ON THE DISTRIBUTION OF DDT AND AROCLOR 1254 IN LABORATORY-GROWN MARINE PHYTOPLANKTON,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
M. Picer, N. Picer, F. Krsinic, and V. Sipos.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 743-748, 1979. 4 fig, 10 ref.

Descriptors: *DDT, *Aroclors, *Phytoplankton, *Adsorption, *Dunaliella, Polychlorinated biphenyls, Pesticide kinetics, Path of pollutants, Chlorinated hydrocarbon pesticides, Marine algae, Chemical analysis, Gas chromatography.

Laboratory cultures of Dunaliella tertiolecta were innoculated with organochlorine compounds. Distribution of the compounds was investigated by chromatography after 2, 24, 48, 216 and 360 hr of phytoplankton growth. The distribution curve of low solubility organochlorine compounds was very complex and unpredictable. (Deal-EIS)
W79-08039

MOBILIZATION AND ACCUMULATION OF SEDIMENT BOUND HEAVY METALS BY ALGAE,
Ottawa Univ. (Ontario). Dept. of Biology.
V. Laube, S. Ramamoorthy, and D. J. Kushner.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 763-770, 1979. 2 fig, 2 tab, 19 ref.

Descriptors: *Cadmium, *Copper, *Anabaena, *Bottom sediments, *Bioaccumulation, Cytological studies, Cyanophyta, Aquatic algae, Path of pollutants, Heavy metals, Sediments, Water chemistry, Sorption, Chemical analysis, Phytoplankton.

The kinetics of cadmium and copper were studied in river water, sediment and algae (Anabaena, Ankistrodesmus). When the heavy metal ions were added to the water, they were taken up by both the algae and sediment. Anabaena was more efficient in metal ion accumulation than Ankistrodesmus. When the source of the metal ions was the sediment, algae accumulated considerable amounts of heavy metal ions. These results suggest that in natural systems algae may play a very important role in mobilizing sediment-bound heavy metal ions. (Deal-EIS)
W79-08040

EFFECTS OF HEAVY METALS ON BENTHIC MACROINVERTEBRATE DENSITIES IN FOUNDRY COVE ON THE HUDSON RIVER,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
T. J. Occhiogrosso, W. T. Waller, and G. J. Lauer.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 230-237, 1979. 1 fig, 4 tab, 12 ref.

Descriptors: *Cadmium, *Nickel, *Sediments, *Distribution patterns, Heavy metals, Fish food organisms, Iron, Zinc, Cobalt, Manganese, Benthic fauna, Industrial wastes, Chemical wastes, Bottom sediments, New York, Foundry Cove, Benthos, Hudson River.

The sediments of Foundry Cove (New York) are contaminated with a number of heavy metals, particularly cadmium and nickel. This report examined the relationship of the sediment and the numbers and/or kinds of macroinvertebrate organisms observed in the sediments. Ten sites were sampled in 1973 and 1974. Bottom sediments were found to contain significant levels of manganese, iron, zinc, cobalt, cadmium and nickel. Cadmium levels up to 48,100 ppm and nickel levels of 11,400 ppm were detected. The stations with the highest contamination levels had the lowest densities of macroinvertebrates. The ability of fish food organisms to survive in highly contaminated sediments greatly increases the potential for biological magnification. (Deal-EIS)
W79-08042

THE EFFECT OF THE LIMING OF FISH-BREEDING PONDS ON SOME CRUSTACEAN PLANKTERS,
Ukrainian Research Inst. of the Fish Industry, Kiev (USSR).
S. A. Krazhan, N. N. Kharitonova, and S. A. Isayeva.
Hydrobiological Journal, Vol. 14, No. 2, p 31-33, 1978. 3 tab, 8 ref.

Descriptors: *Toxicity, *Zooplankton, *Lime, Crustaceans, Copepods, Fish farming, Aquiculture, Daphnia, Mortality, Fertilizers, Fecundity, Animal physiology, Calcium carbonate, Nutrients.

Application of lime to ponds at rates of 500 and 1500 kg/ka is destructive to cladoceran crustaceans (survival 11 percent) and inhibits hatching of copepod young, but has almost no effect on their adult forms. The greatest number of zooplankters dies during the first few days after lime application. To preserve the planktonic crustaceans it is essential to apply the lime uniformly (preferably by spraying) at doses not exceeding 150 to 300 kg/ha combining liming with a subsequent application of mineral fertilizers. (Deal-EIS)
W79-08044

BROWN PELICAN: POPULATION STATUS, REPRODUCTIVE SUCCESS AND ORGANOCHLORINE RESIDUES IN LOUISIANA, 1971-1976,
Fish and Wildlife Service, Corvallis, OR. Patuxent Wildlife Research Center.
L. Blus, E. Cromartie, L. McNease, and T. Joanen.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 128-135, 1979. 3 tab, 21 ref.

Descriptors: *Pesticide residues, *Bird eggs, *Pelicans, DDT, DDD, DDE, Polychlorinated biphenyls, Dieldrin, Endrin, Chlorinated hydrocarbon pesticides, Louisiana, Animal populations, Reproduction, Pesticide toxicity.

The purpose of this report is to further interpret the impact of organochlorine residues on population status and reproductive success of Louisiana brown pelicans. The pelicans were transplanted from Florida to Louisiana between 1968 and 1976. They began breeding in 1971 and the breeding population increased each year until a disastrous die-off in 1975 reduced the population 40%. Eggshell thickness means of pelican eggs from 1971 through 1976 averaged 6.7 to 13.5 less than the mean thickness for eggs collected before 1947. All of the eggs analyzed contained residues of DDE and PCBs. Most eggs also contained residues of DDD, dieldrin and endrin. (Deal-EIS)
W79-08047

TOXICITY AND TERATOGENICITY OF AROMATIC AMINES TO XENOPUS LAEVIS,
Oak Ridge National Lab., TN.
J. M. Dumont, T. W. Schultz, and R. D. Jones.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 159-166, 1979. 3 fig, 4 tab, 16 ref.

Descriptors: *Toxicity, *Embryonic growth stage, *Frogs, *Xenopus, *Tissue analysis, *Aniline, *Quinoline, *Pyridine, *Teratogen, Mortality, Mode of action, Organic compounds, Aromatic compounds, Coals, Fuels, Chemical wastes, Animal behavior.

This report examined the toxicity and teratogenicity of several pure aromatic amines known to be present in coal conversion process waters on the early embryonic stages of the South African clawed frog, Xenopus laevis. Quinoline was more toxic to Xenopus embryos than either aniline of pyridine. The toxicity of quinoline and its 2-methyl derivative was equal, but the toxicity of the 2,6-dimethyl derivative was four times greater. The mortality rates of Xenopus embryos exposed to various concentrations of quinoline and 2-methylquinoline suggest two modes of action for these compounds. The curves for 2,6-dimethylquinoline suggested a single mode of action. In general, size, motility, pigmentation, and rate of development were inversely related to concentration. (Deal-EIS)
W79-08048

CLEARANCE OF ARSENIC INGESTED BY MAN FROM ARSENIC CONTAMINATED FISH,
Fisheries and Marine Service, Halifax (Nova Scotia).
H. C. Freeman, J. F. Uthe, R. B. Fleming, P. H. Odense, and R. G. Ackman.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 224-229, 1979. 1 fig, 1 tab, 8 ref.

Descriptors: *Path of pollutants, *Animal metabolism, *Arsenic compounds, *Arsenic, *Bioaccumulation, Public health, Arsenic excretion, Animal physiology, Chemical analysis, Commercial fishing, Spectrophotometry, Pollutant identification, Digestion, Metals, Humans.

The clearance of total arsenic, by urinary excretion from six volunteers who ate two consecutive meals of commercial fish containing naturally high levels of arsenic is described. During the day prior to consuming the fish, very little arsenic was excreted in the urine of any of the participants. The quantities of arsenic eliminated in the urine over this period ranged from 1.5 to 9.8 micrograms (mean 4.8 micrograms). Two hours following the first meal each subject excreted a significant quantity of arsenic. Two days after eating the fish over 50% of the arsenic ingested had been excreted. The mean total arsenic excreted for all six men up to the ninth day was 77 plus or minus 11% of the 5 mg of arsenic ingested. The remainder of the arsenic may have been retained in the body or may have been excreted via other mechanisms such as fecal or respiratory routes. (Deal-EIS)
W79-08049

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO MARINE MACROBENTHOS,
Pacific Northwest Environmental Research Lab., Newport, OR. Marine Science Center.
R. C. Swartz, W. A. DeBen, and F. A. Cole.
Journal of the Water Pollution Control Fed., Vol. 51, p 944-950, 1979. 1 fig, 4 tab, 9 ref.

Descriptors: *Dredging, *Toxicity, *Benthic fauna, *Polychaetes, Washington, Texas, Virginia, New Jersey, Duwamish River, Bioassay, Amphipoda, Trophic level, Sediments, Crustaceans, Particle size, Waste disposal, Mortality, Animal physiology, Houston Ship Channel, Bailey Creek, Raritan River, Coos Bay.

A bioassay has been developed to determine the acute toxicity of the settleable phase of dredged material to the marine benthos. Five benthic invertebrates representing different taxonomic and trophic positions were allowed to acclimate to control (nonpolluted) sediment and were then covered by a layer of either test or control sediment. Mean survival after 10 days of exposure was significantly different from the control for sediment from the Duwamish River (WA.), Houston Ship Channel (TX.), Bailey Creek (VA.), and the Raritan River (NJ.), but there was no significant difference for sediment from Coos Bay and Skipanon River (OR.). There were substantial interspecific differences in survival among the five test species. The most sensitive species was the infaunal amphipod, Paraphoxus epistomus. (Deal-EIS)
W79-08053

THRESHOLDS FOR DETECTION AND FEEDING BEHAVIOR IN THE DUNGENESS CRAB, CANCER MAGISTER (DANA),
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
W. H. Pearson, P. C. Sugarman, and D. L. Woodruff.
Journal of Experimental Marine Biology and Ecology, Vol. 39, p 65-78, 1979. 2 fig, 2 tab, 32 ref.

Descriptors: *Animal behavior, *Crabs, *Predation, *Chemoreceptors, Clams, Animal physiology, Crustaceans, Food habits, Chemical properties, Water temperature, Laboratory tests.

After observation and description of feeding behavior, the chemosensory ability of the Dungeness crab was measured with sea-water solutions of a freeze-dried extract of the littleneck clam, Protothaca staminea (Conrad). An abrupt change in antennular orientation accompanied by a specified increase in the antennular flicking rate indicated that a crab detected the food extract. The threshold concentration at which 50% of the crabs detected the calm extract was 0.0000000001 g/l. At 0.01 g/l crabs probed the substratum with the chelae and/or showed other feeding behavior. The chemosensory abilities of the Dungeness crab were compared with those of other crustaceans. (Deal-EIS)
W79-08054

THE MARINE ALGAE OF ELIE, SCOTLAND: A RE-ASSESSMENT,
Heriot-Watt Univ., Edinburgh, (Scotland). Dept. of Brewing and Biological Sciences.
M. Wilkinson, and I. Tittley.
Botanica Marina, Vol. 22, p 249-256, 1979. 2 fig, 6 tab, 22 ref.

Descriptors: *Marine algae, *Monitoring, *Species diversity, *Scotland, Path of pollutants, Dominant organisms, Biological communities, Chlorophyta, Phaeophyta, Rhodophyta, Aquatic algae, Water pollution effects, Ecological distribution, Firth of Forth.

No change has been found between the survey of Traill in 1888 and the present work in the species richness of marine algae at Elie on the north coast of the Firth of Forth in Scotland. This is compared to Joppa and Dunbar on the south coast of the Firth of Forth where, in the case of the former, a great species reduction has occurred since Traill's time, while it has not occurred at Dunbar. The changes are in accord with the likely distribution of pollutants in the Forth. Comparison of changes in detailed species recordings and in numerical species richness is made in relation to pollution monitoring schemes. It is suggested that those pollution monitoring schemes which rely solely on quantitative distributional data of common species are inadequate and that some estimate of species richness should be included in such schemes. (Deal-EIS)
W79-08058

RESPIRATORY RESPONSES OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) TO ENVIRONMENTAL CHANGES IN TEMPERATURE AND DISSOLVED OXYGEN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
J. J. Cech, Jr., C. G. Campagna, and S. J. Mitchell.
Transactions of the American Fisheries Society, Vol. 108, p 166-171, 1979. 2 fig, 2 tab, 15 ref.

Descriptors: *Respiration, *Bass, *Water temperature, *Dissolved oxygen, *Tissue analysis, Fish physiology, Animal metabolism, Oxygen requirements, Mortality, Drought tolerance, Chemical analysis, Hydrogen ion concentration, Bass.

Respiratory metabolic rates of largemouth bass were measured in flow-through respirometers under various temperature and dissolved oxygen conditions simulating drought environments. 'Critical' oxygen tensions increased from < 40 torr PO2 at 20 C, to 40-50 torr at 25 C, to 50-60 torr at 30 C. Evidence from arterial blood samples indicated increased anaerobic metabolism associated with an oxidative metabolic depression at high temperatures and low dissolved oxygen concentrations. Procedures to maintain 2.60 mg O2/liter at 25 C and 2.85 mg O2/liter at 30 C in largemouth bass habitats should minimize adult mortalities linked to insufficient oxygen. (Deal-EIS)
W79-08059

EFFECT OF SALINITY AND MANGANESE ON MEDIDOTEA ENTOMON,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
A. F. Karpevich, and A. T. Shurin.
Hydrobiological Journal, Vol. 14, No. 1, p 72-77, 1978. 6 fig, 8 ref.

Descriptors: *Salinity, *Manganese, *Toxicity, *Isopods, *Bioaccumulation, *Tissue analysis, Baltic Sea, Dissolved oxygen, Chlorides, Metals, Mortality, Inhibition, Animal metabolism, Respiration, Animal physiology, Oxygen demand.

It was found in short- and long-term experiments that M. entomon from the Pyarnz and Riga Gulfs is capable of survival in the salinity range of 3 to 14%, and tolerates an oxygen concentration of 1.0 to 1.4 ml/liter, as well as a manganese chloride concentration of 2.5 to 12 mg/liter. Manganese chloride concentrations of 17 to 20 mg/liter are critical, since at these concentrations significant quantities of manganese accumulate in organs and tissues, inhibiting metabolism, depressing activity, and ultimately causing death of these isopods. (Deal-EIS)
W79-08060

AN ENVIRONMENTAL CHAMBER FOR MONITORING 'IN SITU' GROWTH AND SURVIVAL OF LARVAL FISHES,
National Marine Fisheries Service, Narragansett, RI. Narragansett Lab.
G. C. Laurence, T. A. Halavik, B. R. Burns, and A. S. Smigielski.
Transactions of the American Fisheries Society, Vol. 108, p 197-203, 1979. 1 fig, 4 tab, 19 ref.

Descriptors: *On-site data collections, *Fish populations, *On-site tests, *Flounder, Analytical techniques, Larval growth stage, Monitoring, Predation, Zooplankton, Growth rates, Mortality, Water chemistry, Dissolved oxygen, Salinity, Water temperature, Productivity, Fish food organisms, Methodology.

An 'in situ' experiment using an environmental chamber to monitor growth and survival of laboratory-produced winter flounder larvae (Pseudopleuronectes americanus) was completed in the Pettaquamscutt Estuary of Narragansett Bay. The prototype enclosure was of open mesh allowing the larvae to be exposed to natural, varying conditions. One thousand larvae were stocked in the chamber where they remained for a 2-week period. Zooplankton prey concentrations, temperature, salinity, and dissolved oxygen were monitored day and night both inside and outside the chamber. Survival rate was 76.8% and all the survivors metamorphosed. Daily specific growth rates were 10.7% dry weight and 1.9% standard length. Sample analyses indicated physical conditions were good for winter flounder growth and that zooplankton prey densities were high. There were no statistically significant differences between prey densities inside and outside the chamber. This research was considered to be a 'transitional study' linking laboratory and field research, and results were comparable with previous laboratory and field studies. (Deal-EIS)
W79-08061

CRASSOSTREA VIRGINICA AS AN INDICATOR OF LEAD POLLUTION,
Environmental Research Lab., Narragansett, RI.
G. E. Zaroogian, G. Morrison, and J. F. Heltshe.
Marine Biology, Vol. 52, p 189-196, 1979. 5 fig, 22 ref.

Descriptors: *Lead, *Oysters, *Bioindicators, *Crassostrea, *Tissue analysis, *Bioaccumulation, *Depuration, Growth rates, Chemical analysis, Heavy metals, Salinity, Water temperature, Path of pollutants, Adsorption, Toxicity.

After treatment with 1.0 and 3.3 micrograms Pb Kg/l for 20 weeks in flowing seawater at ambient salinity and temperature, Crassostrea virginica accumulated as much as 6.57 and 11.42 micrograms Kg/l dry weight, respectively, and no mortalities were recorded. Lead uptake was curvilinear; however, the general trend was an increase in lead concentration over time. Dry weight of the oyster had no significant relation with tissue lead concentration however, a significant positive relationship existed between weight and lead content. A decrease in lead concentration in the tissues occurred from mid-August to mid-September despite continuous addition of lead to the seawater. Addition of lead to the seawater was terminated after 20 weeks (October), and lead loss was studied for the following 12 weeks. Lead loss was studied well after spawning in an attempt to eliminate any influence this might have on lead concentration in the tissues. After 4 weeks, approximately 54% accumulated lead was lost under conditions of a natural temperature decline. The biological half-life of lead in C. virginica tissues was calculated to be 5.5 weeks. In the ensuing 8 weeks, little or no lead loss was observed. Larvae from each treatment developed to the straight-hinged stage within 48 h with no apparent abnormalities. Lead appeared to have no adverse effect on larvae when parents had been treated with 1.0 and 3.3 micrograms Kg/l seawater for 10 weeks. (Deal-EIS)
W79-08064

BEHAVIORAL CHANGES IN BLUEGILL (LEPOMIS MACROCHIRUS) AS INDICATORS OF SUBLETHAL EFFECTS OF METALS,
Iowa State Univ., Ames. Dept. of Animal Ecology.
M. G. Henry, and G. J. Atchison.
Environmental Biology of Fish, Vol. 4, No. 1, p 37-42, 1979. 2 tab, 23 ref.

Descriptors: *Fish behavior, *Toxicity, *Zinc, *Cadmium, Metals, Mode of action, Fish physiology, Sunfishes, Bioindicators, Water quality standards, Bioassay, Animal behavior, Bluegill sunfish, Monitoring.

The development of rapid, yet sensitive toxicity testing methods is needed for the establishment of water quality standards to protect aquatic life. A technique using changes in the behavior of bluegill was utilized to evaluate the impact of five sublethal levels of a cadmium and zinc mixture. The technique proved very sensitive and various changes in behavior occurred at the lowest metal levels used; 21 micrograms Cd per liter and 99 micrograms Zn per liter. Coughs, Yawns, partial jerks and jerk swimming were especially sensitive indicators of elevated metal levels. The frequency, but not the form, of eight of the nine behaviors quantified changed significantly with increasing metal levels. (Deal-EIS)
W79-08065

DDT INDUCED ETHOLOGICAL CHANGES IN ESTUARINE FISH,
Centre of Advanced Study in Marine Biology, Porto Novo (India).
T. Lingaraja, P. S. B. Rao, and V. K. Venugopalan.
Environmental Biology of Fish, Vol. 4, No. 1, p 83-88, 1979. 7 fig, 6 ref.

Descriptors: *DDT, *Fish behavior, *Pesticide toxicity, Predation, Mode of action, Fish food organisms, Feeding rates, Perches, Mullets, Bioindicators, Estuarine environment, Chlorinated hydrocarbon pesticides, Water pollution effects.

Experiments were carried out to study the feeding rates of the predator fish Therapon jarbua (Forsk) on mullet juveniles, before and after treatment with DDT. Mullet juveniles treated with a subacute concentration were refused by the control predators, whereas predators treated with a subacute concentration consumed more mullet juveniles. In the present study crescent perch (T. jarbua) were exposed to subacute and acute concentrations of DDT and their behaviour was compared with that of the control predators. There were changes in oriented behaviour and co-ordin-

ated movements, and in feeding, aggression and comfort behaviour of the fish. Inflammation in the gills and caudal fin serration were noticed in treated fishes. The findings presented here throw light on fundamental pathways by which pollutants interact with the behaviour of fishes. (Deal-EIS)
W79-08066

EVIDENCE OF WEIGHT-DEPENDENT DIFFERENTIAL HEMATOLOGICAL RESPONSE TO INCREASED ENVIRONMENTAL TEMPERATURE BY CARP, CYPRINUS CARPIO,
Brock Univ., St. Catherines (Ontario). Dept. of Biological Sciences.
J. S. Smeda, and A. Houston.
Environmental Biology of Fishes, Vol. 4, No. 1, p 89-92, 1979. 1 fig, 2 tab, 13 ref.

Descriptors: *Water temperature, *Carp, *Fish physiology, *Hemopoesis, *Tissue analysis, Weight, Size, Calcium, Animal metabolism, Oxygen requirements, Chemical analysis, Growth rates, Regression analysis, Hematology, Biochemistry.

Hematological response to increased temperature was evaluated in carp acclimated to 2 degrees, 16 degrees and 30 degrees C by reference to hemoglobin level, hematocrit red cell number and mean crythrocytic volume and hemoglobin content. Although only modest variations were observed in terms of mean values, regression of these parameters against weight indicated that response in smaller specimens greatly exceeded that of larger animals. Variations in red cell numbers and hemoglobin were well correlated with plasma calcium, and it is suggested that temperature-induced hypercalcemia may play some role in the triggering of hemopoesis. (Deal-EIS)
W79-08067

STRUCTURE RELATED UPTAKE OF CHLORINATED PARAFFINS IN BLEAKS (ALBURNUS ALBURNUS L),
National Swedish Environment Protection Board, Studsvik (Sweden). Brackish Water Toxicology Lab.
B.-E. Bengtsson, O. Svanberg, E. Linden, G. Lunde, and E. B. Ofstad.
Ambio, Vol. 8, No. 2-3, p 121-122, 1979. 1 fig, 1 tab, 9 ref.

Descriptors: *Absorption, *Fish physiology, Oil, Oil spills, *Bleak, *Alburnus, *Paraffins, *Chlorinated paraffins, *Bioaccumulation, *Tissue analysis, Organic compounds, Chlorination, Animal metabolism, Chemical analysis, Polychlorinated biphenyls, Chemical properties, Toxicity, Fish behavior.

The uptake from the water of chlorinated paraffins (CP) with various carbon chain lengths and various levels of chlorination was studied in bleaks, Alburnus alburnus L. Subsequent elimination from the fish, when placed in clean water, was also traced. CPs with short carbon chain lengths and low levels of chlorination showed the highest uptake. The CP's had a lower uptake than the tested PCB formulation, but demonstrated a comparatively high retention. Symptoms of toxic effects of CPs were also noted. (Deal-EIS)
W79-08073

SPECIFIC AND NONSPECIFIC CHANGES INDUCED IN FISH BY VARIOUS TOXIC AGENTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. Ya. Malyarevskaya.
Hydrobiological Journal, Vol. 14, No. 2, p 52-59, 1978. 6 tab, 27 ref.

Descriptors: *Toxicity, *Fish physiology, *Mode of action, *Tissue analysis, Animal metabolism, Chemical properties, Cyanophyta, DDT, Enzymes, Proteins, Organic compounds, Mortality, Respiration, Inhibition, Carp, Perches, Chemical analysis, Pesticide toxicity, Trichlorfon.

The concepts of 'specific' and 'nonspecific' changes are formulated. A comparison is made, on the basis of the author's own and literature data, of the disturbances in metabolic processes induced in fish by agents of differing origin and chemical structure such as metabolites and toxins of blue-green algae, DDT, and Trichlorfon. Comparison of the changes in respiration, protein metabolism, cholinesterase activity, and content of nicotinamide coenzymes made it possible to identify the general and the specific in the mechanisms of action of these agents on fish. (Deal-EIS)
W79-08074

DYNAMICS OF ZINC-65 SPECIFIC ACTIVITY AND TOTAL ZINC IN BENTHIC FISHES ON THE OUTER CONTINENTAL SHELF OFF CENTRAL OREGON,
Oregon State Univ., Corvallis. School of Oceanography.
H. A. Vanderploeg.
Marine Biology, Vol. 52, p 259-272, 1979. 7 fig, 5 tab, 31 ref.

Descriptors: *Fish physiology, *Absorption, *Zinc radioisotopes, *Tissue analysis, *Bioaccumulation, *Flounder, Path of pollutants, Size, Marine fish, Food webs, Zinc, Fish food organisms, Radioecology, Radiochemical analysis, Tracers, Benthic fauna, Mathematical models, Chemical properties.

The dynamics of 65Zn specific activity and total zinc in benthic fishes on the outer continental shelf off central Oregon were examined. A differential equation that relates specific activity of 65Zn in fish to that in fish food was used to estimate a's (zinc uptake-rate coefficients) for 3 different size classes of the flounder Lyopsetta exilis, and for 1 size class of the flounder Microstromus pacificus. The a's obtained for L. exilis were very close to the a obtained in the laboratory for the flounder Pleuronectes platessa. The a estimated for M. pacificus was very much smaller than the a's estimated for the other two species. A model that related a to predicted weight-specific feeding rates suggested that the smaller a of M. pacificus was caused by a low absorption efficiency of zinc from its prey. Sensitivity studies indicated that time histories of specific activity in the fishes are not sensitive to moderate changes in a. The negative correlation between specific activity in the diet and in the weight of L. exilis was the major cause of the negative correlative between specific activity and weight in this species. In M. pacificus, where composition of diet does not vary with size, specific activity was independent of weight. The time history of specific activity in M. pacificus was very much lower than those in the different size classes of L. exilis, a result caused mainly by the much lower specific activity of the prey of M. pacificus. Differences in specific activity among other benthic fishes were also correlated with differences in specific activity of their prey. The food-web dynamics responsible for these patterns are discussed. (Deal-EIS)
W79-08075

UPTAKE AND LOSS OF RADIOACTIVE CADMIUM BY THE SEA-SKATER HALOBATES ROBUSTUS (HETEROPTERA: GERRIDAE),
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
M. Schulz-Baldes, and L. Cheng.
Marine Biology, Vol. 52, p 253-258, 1979. 3 fig, 20 ref.

Descriptors: *Cadmium radioisotopes, *Absorption, *Insects, *Tissue analysis, *Bioaccumulation, *Sea-skaters, *Halobates, Bioassay, Radiochemical analysis, Tracers, Path of pollutants, Cadmium, Animal physiology, Animal metabolism, Water chemistry, Radioactivity, Techniques.

Sea-skaters caught around the Galapagos Islands, were exposed over a period of 3 days to radioactive cadmium dissolved in seawater. Although 115mcd (metastable 115Cd) was accumulated by the insects, they did not concentrate it above the seawater level. The experiments clearly showed that cadmium is taken up into the body, not merely adsorbed onto surfaces. The uptake of Cd followed a biphasic time course. When sea-skaters labelled in this way were transferred back into unlabelled seawater, the rate of loss of Cd was likewise biphasic. During uptake and loss, the biological half-life times for the first compartments were almost identical (0.64 and 0.79 h), indicating that the same compartment might be involved. On the other hand, the biological half-life times for the second compartments were different (1.7 days during uptake, 19.5 days during loss), indicating that the site or chemical form of bound Cd in the sea-skater had changed. (Deal-EIS)
W79-08076

THE EFFECT OF NUTRITION ON THE RESPONSE OF FIELD POPULATIONS OF THE CALANOID COPEPOD ACARTIA TONSA TO COPPER,,
Environmental Research Lab., Narragansett, RI.
S. L. Sosnowski, D. J. Germond, and J. H. Gentile.
Water Research, Vol. 13, p 449-452, 1979. 2 fig, 15 ref.

Descriptors: *Copepods, *Copper, *Toxicity, Bioassay, Mortality, Lethal limit, Zooplankton, Aquatic populations, Algae, Phytoplankton, Population, Chlorophyll, Chemical analysis, Metals, Predation, Biomass, Seasonal, Narragansett Bay.

Continuous flow toxicity tests were conducted on field populations of adult Acartia tonsa collected from Narragansett Bay. Potential algal food at the collection site was estimated from ATP and chlorophyll analysis. Integration of these data with quantitative zooplankton analysis established that A. tonsa had a significant grazing effect on algal biomass (P 0.05). The natural population dynamics of A. tonsa during this period were assessed from microscopic analysis of tow material. The sensitivity of A. tonsa to total copper ranged from 9.0 to 78.0 micrograms/l for 72 h LC50's. Results show an inverse correlation (P 0.05) between the log LC50 and adult A. tonsa density at the time of collection. The relationship between A. tonsa sensitivity to copper and the food ration (algal density/A. tonsa density) has been described by a quadratic function which has a correlation coefficient of 0.78. This indicates that the log LC50 increases with increasing food ration up to a point and then remains constant. A comparison of confidence intervals about the LC50's indicates greater variability in the response of field animals compared to previous studies with cultured populations. This data suggests that field populations of A. tonsa can be expected to exhibit a wide range of sensitivity to other pollutants. Sensitivity is strongly correlated with population density and food ration. (Deal-EIS)
W79-08079

THE EFFECTS OF MONOCHLORAMINE ON SELECTED RIVERINE FISHES,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
G. L. Seegert, A. S. Brooks, J. R. V. Castle, and K. Gradall.
Transactions of the American Fisheries Society, Vol. 108, p 88-96, 1979. 3 tab, 23 ref.

Descriptors: *Bioassay, *Chlorine, *Freshwater fish, *Chloramines, Biocides, Toxicity, Mortality, Water temperature, Chlorination, Control, Shiners, Channel catfish, Suckers, Bass, Sunfishes, Carp, Fish physiology.

Ten riverine fish species were tested at 10, 20, and 30 C to determine their resistance to monochloramine. The exposure regime consisted of four 40-minute exposures administered at 5-hour intervals over 24 hours. All species exhibited an inverse relationship between temperature and medain lethal (LC50) concentrations. LC50 values generally decreased by a factor of two as the exposure temperature increased from 10 to 30 C. LC50 values ranged from 0.35 mg/liter at 30 C for the emerald shiner to 3.00 mg/liter at 10 C for the bluegill. Based on their resistance to monchloramine at 30 C the fish were separated into sensitive and resistant groups. The sensitive group, which included (in decreasing order of sensitivity) the emerals shiner (Notropis atherinoides), spotfin shiner (Notropis spilopterus), common shiner (Notropis cornutus), channel catfish (Ictalurus puncta-

tus), white sucker (Catastomus commersoni), and sauger (Stizostedion canadense), had LC50 values ranging from 0.35 to 0.71 mg/liter. The resistant group, freshwater drum (Aplodinotus grunniens), white bass (Morone chrysops), bluegill (Lepomis macrochirus), and carp (Cyprinus carpio) had LC50 values of 1.0-1.50 mg/liter. (Deal-EIS)
W79-08081

POLONIUM-210 AND LEAD-210 IN MARINE FOOD CHAINS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
M. Heyraud, and R. D. Cherry.
Marine Biology, Vol. 52, p 227-236, 1979. 2 fig, 7 tab, 25 ref.

Descriptors: *Lead radioisotopes, *Food chains, Lead, Metals, *Polonium, *Tissue analysis, *Bioaccumulation, *Tuna, Path of pollutants, Tracers, Radioactivity techniques, Radiation, Chemical analysis, Crustaceans, Mollusks, Shrimp, Fallout, Radiochemical analysis.

210Po and 210Pb have been measured systematically in whole animals, muscle and hepatopancreas of crustaceans and of molluscan cephalopods representative of a pelagic and benthic food chain. The same nuclides were also measured in liver, pyloric caecum, stomach contents and muscle of tuna. The concentration factors from sea water to whole animals were approximately constant along both food chains, being of the order of 10000 for 210Po and 100 for 210Pb. The highest concentration factors were found in shrimp of the genus Sergestes. In muscle, the concentration factors were an order of magnitude less; in the hepatopancreas, they were an order of magnitude higher, reaching 1,000,000 in shrimp of the genus Sergestes. Such concentrations imply alpha-radiation doses of the order of 10 rem per year and more in this organ, which contains about 50 to 90% of the 210Po in the whole animal in the 11 species analyzed. A detailed study of the intracellular behaviour of 210Po in the hepatopancreas is clearly indicated. 210Po can be used as a sensitive natural tracer in biological systems. Thus, feeding Meganyctiphanes norvegica in the laboratory on food low in 210Po led to an approximate value of about 6 1/2 days for the biological half-life of 210Po in the hepatopancreas of this euphausiid. Furthermore, the data on 210Po and 210Pb in the cephalopod hepatopancreas allowed the time of conservation of frozen squid which had been bought at the market to be estimated. (Deal-EIS)
W79-08082

INFLUENCE OF THREE SEDIMENT TYPES ON COPPER TOXICITY TO THE POLYCHAETE NEANTHES ARENACEODENTATA,
Environmental Research Lab. Narragansett, RI.
For primary bibliographic entry see Field 5C.
W79-08083

TRANSFER OF MERCURY FROM FISH CARCASS TO FORMICA AQUILONIA (HYMENOPTERA, FORMICIDAE),
Helsinki Univ. (Finland). Dept. of Environmental Conservation.
P. Nuorteva, H. Wuorenrinne, and M. Kaistila.
Annales Entemologici Fennici, Vol. 44, No. 3, p 85-86, 1978. 1 tab, 7 ref.

Descriptors: *Mercury, *Path of pollutants, *Insects, *Ants, *Bioaccumulation, *Tissue analysis, Chemical analysis, Heavy metals, Insect behavior, Food habits, Food chains, Scavengers, Animal populations.

A piece of mercury-contaminated fish (3.2 ppm) placed in a nest of Formica aquilonia Yarr. elevated the mercury content of the ants from 0.028 ppm to 0.163 ppm. When a similar piece of fish was placed at a distance of 5 m from a nest, the mercury content of the ants rose only slightly. No stabilization or decrease in mercury content was observerved during the test period. (Deal-EIS)
W79-08084

THE APPLICATION OF PLASTIC ENCLOSURES TO THE STUDY OF PELAGIC MARINE BIOTA,
Skidaway Inst. of Oceanography, Savannah, GA.
D. W. Menzel, and J. H. Steele.
Rapports Et Proces-Verbaux Des Reunions Conseil International Pour L'Exploration De La Mer, Vol. 173, p 7-12, 1978. 8 fig, 1 tab, 20 ref.

Descriptors: *Research equipment, *Pelagic biota, On-site data collections, On-site laboratories, On-site investigations, Analytical techniques, Aquatic populations, Phytoplankton, Trophic level, Zooplankton, Eutrophication, Water pollution effects, Biological communities.

Flexible plastic containers, ranging in volume from 1 to 2000 cubic meters, have been used to isolate water columns with their included organisms for biological-chemical studies of pelagic biota. Such containers have been applied to investigate phytoplankton dynamics, natural cycles in mixed trophic level ecosystems, and the effects of eutrophication and pollutants. They are in a sense analogous to controlled experimental plots used in agricultural research and perhaps are the best approach currently available to study the same pelagic populations over extended periods of time. The ability of the containers to support 'higher' trophic level organisms is directly related to the size of the enclosure. The 'optimum' practical volume of containers for mixed trophic level studies is most likely between 1000 and 2000 cubic meters when the column depth is 1.5 times that of the euphotic zone. The physical dimensions of any container, however, cannot be made large enough to examine phyto-zooplankton interactions in both spatial and temporal dimensions which characterize natural distributions in the ocean. Their utility is largely in studying interactions and rate processes over time. (Deal-EIS)
W79-08085

INFLUENCES OF SELECTED ENVIRONMENTAL FACTORS ON THE ACTIVITY OF A PROSPECTIVE FISH TOXICANT, 2-(DIGERANYLAMINO)-ETHANOL, IN LABORATORY TESTS,
National Fishery Research Lab., LaCrosse, WI.
C. A. Launer, and T. D. Bills.
Investigations in Fish Control, Report No. 88, 1979. 4 p, 5 tab, 9 ref.

Descriptors: *Toxicity, *Pesticides, *Fish phsysiology, *Elodea, *Lemna, Fish control agents, Minnows, Brown trout, Rainbow trout, Water temperature, Hydrogen ion concentration, Turbidity, Ultraviolet radiation, Vegetation effects, Acidic water, Water chemistry, Chemical properties.

Fathead minnows, brown trout, and rainbow trout were used to assess the influences of temperature, pH, turbidity, ultraviolet light, and aquatic vegetation on the toxicity of an experimental fish toxicant, 2-(digeranylamino)-ethanol (GD-174). Also examined was the feasibility of chemical counteraction by oxidation or reduction. The activity of the compound was reduced in cold water, in acid water, and in turbid water where the turbidities were produced by bentonite or Crowley silt loam, and in water containing waterweed (Elodea sp.). The activity was not affected by exposure to ultraviolet light, by the presence of duckweed (Lemna sp.) or by turbidities produced by kaolin or barium sulfate. GD-174 can be counteracted by either oxidation or reduction; oxidation by potassium permanganate was the most effective procedure tested. (Deal-EIS)
W79-08087

THE IMPACT OF OIL POLLUTION ON INTERTIDAL MEIOFAUNA. FIELD STUDIES AFTER THE LA CORUNA-SPILL, MAY 1976,
Hamburg Univ. (Germany, F.R.). Museum of Zoology.
O. Giere.
Cahiers de Biologie Marine, Vol. 20, p 231-251, 1979. 5 fig, 1 tab, 52 ref.

Descriptors: *Oil spills, *Toxicity, *Intertidal areas, *Meiofauna, *Crude oil, *Spain, *Species diversity, Biological communities, Oil, Oil pollution, Organic compounds, Nematodes, Annelids, Coasts, Beaches, Dominant organisms, Habitats, La Coruna.

The effect of oil contamination by the spill from the super-tanker 'Monte Urquiola' on the intertidal meiofauna was studied shortly after the accident and also one year later. The investigated sites along the northern Spanish coast covered an area from heavily polluted shores to beaches without visual oil contamination. The impact on the meiofauna could be related to the exposure of the sampling stations to the center of the spill and affected the various taxonomical groups differently, many nematodes and annelids being relatively resistant, harpacticoids and turbellarians more sensitive. Within one year, the meiofauna had recovered considerably with regard to diversity and abundance, both of which had been heavily suppressed shortly after the spill. The reasons for this relatively quick reappearance and the different reactions of interstitial fauna to oil contamination are discussed in relation to the specific habitat properties in the area. (Deal-EIS)
W79-08089

SOURCES OF POLLUTION FROM AGRICULTURAL DRAINAGE,
California Regional Water Quality Control Board, Sacramento. Central Valley Region.
For primary bibliographic entry see Field 5B.
W79-08094

A STATISTICAL MODEL FOR PREDICTING CHLOROFORM LEVELS IN CHLORINATED SURFACE WATER SUPPLIES,
Massachusetts Univ., Amherst.
G. S. Moore, R. W. Tuthill, and D. W. Polakoff.
Journal of the American Water Works Association, Vol. 71, No. 1, p 37-39, January 1979. 2 tab, 1 fig, 7 ref.

Descriptors: *Statistical models, *Regression analysis, *Water quality, *Chloroform levels, *Chlorinated water, *Water supply, Surface waters, Raw water, Treated water, Systems analysis, Massachusetts, Prediction.

Multiple regression analysis of a number of routinely measured characteristics--temperature, turbidity, color, pH free residual chlorine, total residual chlorine, and chloroform--of the raw water, finished plant water, and distribution system water of nineteen Massachusetts communities showed chlorine dosage to be the most reliable predictor of chloroform levels in the water supply. A set of Pearson product moment correlations were computed between each of the water characteristics and the distribution system chloroform levels. (Bell-Graf--Cornell)
W79-08212

METHOD AND APPARATUS FOR ANALYSIS OF WATER,
Commonwealth Scientific and Industrial Research Organization, Campbell (Australia). (Assignee).
V. A. Garten, R. McNeill, J. M. Overbeek, and R. B. Head.
U.S. Patent No. 4,140,487, 10 p, 5 fig, 1 tab, 3 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 3, p 993, February 20, 1979.

Descriptors: *Patents, *Pollutant identification, *Water pollution, Water quality control, Analytical techniques, Organic matter, Inorganic compounds, Ozone, Light, Equipment.

A method is presented for detecting the presence in water of substances which are rapidly oxidized by ozone with the emission of quanta of visible light. The method comprises contacting the water with ozone and detecting the light quanta emitted. Water which contains any organic substances having SH groups (present in almost all proteins), phenolic OH groups and olefinic double bonds and/or inorganic sulphides and/or ammonia will, on reaction with ozone, produce visible light quanta. The apparatus for carrying out the method of the invention comprises a reaction vessel to

contain a body of water, means for generating and supplying ozone to water in the vessel, means for introducing a test sample of water into the vessel, and means for detecting light emitted from the water. (Sinha-OEIS)
W79-08221

A NATIONAL SURVEY FOR CADMIUM, CHROMIUM, COPPER, LEAD, ZINC, CALCIUM, AND MAGNESIUM IN CANADIAN DRINKING WATER SUPPLIES,
Environmental Health Center, Ottawa (Ontario).
J. C. Meranger, K. S. Subramanian, and C. Chalifoux.
Environmental Science and Technology, Vol. 13, No. 6, p 707-711, June 1979. 6 tab, 20 ref.

Descriptors: *Metals, *Trace elements, *Water supplies, *Canada, Heavy metals, Surveys, Sampling, Chemical analysis, Spectrophotometry, Cadmium, Chromium, Copper, Lead, Zinc, Calcium, Magnesium, Hardness(Water), Potable water, Pollutants, Pollutant identification, Water quality, *Newfoundland, *Manitoba.

A national survey was conducted to determine the levels of Cd, Cr, Cu, Pb, Zn, Ca, and Mg in Canadian drinking water supplies. Samples of raw, treated, and distributed water, obtained from 70 municipalities across Canada, were analyzed by atomic absorption spectrometry. The concentrations of trace metals found were essentially the same for all 3 types of water samples. The median and range values for distributed water expressed as ng of metal/mL of water were found to be: Cd less than 0.01 (less than 0.01-0.49); Cr less than 2.0 (less than 2.0-8.0); Cu, 20 (5.0-620); Pb less than 1.0 (less than 1.0-65.0); Zn, 10 (less than 5.0-380). Values for water hardness, expressed as mg of CaCO3/L, ranged from 1 in St. John's, Newfoundland, to 554 in Selkirk, Manitoba. Contamination of the water supplies with these metals, except copper, was minimal during treatment and distribution. In all cases, the median values for the distributed water were well below the WHO upper limit recommendations. (Sims-ISWS)
W79-08258

PARTICULATE ZINC, CADMIUM, LEAD, AND COPPER IN THE SURFACE MICROLAYER OF SOUTHERN LAKE MICHIGAN,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. W. Elzerman, D. E. Armstrong, and A. W. Andren.
Environmental Science and Technology, Vol. 13, No. 6, p 720-725, June 1979. 3 fig, 5 tab, 35 ref.

Descriptors: *Metals, *Trace elements, *Sampling, *Lake Michigan, *Great Lakes, Chemical analysis, Filtration, Surveys, Chemicals, Heavy metals, Zinc, Cadmium, Lead, Copper, Pollutants, Pollutant identification, Water quality, Particulate matter, Surface layers.

Particulate matter of diverse composition and morphology commonly occurred in higher concentrations in screen-collected surface microlayer (SM) samples than in the bulk water of southern Lake Michigan. Filtration experiments (0.4 micrometer Nuclepore) indicated that enrichment of Zn, Cd, Pb, and Cu in the SM occurred substantially in the particulate phase, especially when surface enrichments were large. Surface enrichment of total particulate matter and Zn, Cd, Pb, and Cu was related to the presence of surface accumulated material and film pressure. Chemical analysis indicated that a significant portion of the particulate Zn, Cd, Pb, and Cu in the SM may be atmospherically transported anthropogenic particulate matter. (Sims-ISWS)
W79-08259

AUTOMATED CHEMICAL ANALYSIS FOR MEASURING MICROGRAM LEVELS OF ORGANIC CARBON IN POTABLE WATERS,
National Inst. for Water Research, Pretoria (South Africa).
R. A. van Steenderen, W. D. Basson, and F. A. van Duuren.
Water Research, Vol. 13, No. 6, p 539-543, 1979. 4 fig, 1 tab, 6 ref.

Descriptors: *Chemical analysis, *Automation, *Carbon, *Potable water, Organic compounds, Equipment, Instrumentation, Chemicals, Measurement, Sampling, Chemistry, Water chemistry, Pollutants, Pollutant identification, Water pollution, Water quality.

An automated method for the direct determination of microgram levels of organic carbon in potable waters was described. The technique is that of continuous flow analysis and utilizes an automatic sampler, a multiple channel proportioning pump, and an appropriate analytical system (manifold). Samples are acidified, oxygen segmented, and passed through a heated inorganic carbon removal was not possible. The stripped liquid was re-sampled, mixed with silver peroxydisulphate solution, and digested at 70 C. The liberated CO2 was measured by means of infrared photometry. Complete inorganic carbon removal was not possible. From a 30 mg/cu dm inorganic carbon solution, 0.1% residual remained after stripping. Using a sample volume of 6.3 cu cm/min full-scale recorder deflection could be obtained for a 1 mg/cu dm organic carbon standard solution with a relative standard deviation of 0.9%. The lower detection limit of practical significance is 50 microgram/cu dm organic carbon. The analysis rate was 20 samples per hour. Certain synthetic organic materials resisted complete oxidation and included the amino acids glycine, 1-alanine, leucine, iso-leucine and valine. (Sims-ISWS)
W79-08260

DETERMINATION OF HEAVY METALS AND SELENIUM IN FISH FROM UPPER AUSTRIAN WATERS -- PART 2: LEAD, CADMIUM, SCANDIUM, CHROMIUM, COBALT, IRON, ZINC AND SELENIUM (IN GERMAN),
Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie.
D. K. Teherani, G. Shehlik, N. Tehrani, H. Schada, and J. Hinteregger.
Environmental Pollution, Vol. 18, p 241-248, 1979. 1 tab, 1 app, 9 ref. (English Abstract).

Descriptors: *Heavy metals, *Fish populations, *Path of pollutants, *Tissue analysis, *Bioaccumulation, *Scandium, *Selenium, *Austria, Lead, Cadmium, Chromium, Cobalt, Iron, Zinc, Chemical analysis, Fish physiology, Neutron activation analysis.

119 samples of fish caught in September 1974 in Upper Austrian waters were analyzed for zinc, iron, cobalt, chromium, scandium and selenium by neutron activation analyses and for lead and cadmium by atomic absorption spectrometry. The concentration values found for Zn ranged between 13 and 44 ppm, for Fe between 11 and 111 ppm, for Co between 0.01 and 0.40 ppm, for Cr between 0.02 and 0.21 ppm, for Pb between 0.01 and 0.13 ppm with a single exception, for Cd between 0.01 and 0.13 ppm and for Se between 0.62 and 2.02 ppm. The concentration of Sc was below the detection limit (0.5 pptm) for all fish samples analysed. (Deal-EIS)
W79-08276

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH - IV EFFECTS ON ULTRASTRUCTURES OF HEPATIC AND RENAL CELLS OF THE CARP AND THE PORGY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
J. Koyama, M. Fujita, and Y. Itazawa.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 429-436, 1979. 4 pl. 15 ref.

Descriptors: *Cadmium, *Carp, *Toxicity, *Porgy, Fish physiology, Cytological studies, Electron microscopy, Path of pollutants, Heavy metals, Animal pathology, Chemical analysis, Mode of action, Water pollution effects.

Carp (Cyprinus carpio) were fed for 30 days (0, 140 and 1700 ppm) or 14 days (5700 ppm) on feed containing Cd of 0, 140, 1700 or 5700 ppm in the dry weight. Porgy (Pagrus major) were fed for 113 days on feed containing Cd of 0, 37.5, 150 or 375 ppm in the dry weight. In the hepatic cells of both fishes fed on Cd-containing feed the most remarkable alterations were increase and enlargement of lysosomes with the increase of Cd content in feed. Decrease of glycogen granules (carp and porgy), increase and dilation of smooth-surfaced endoplasmic reticulum (carp), and increase of rough-surfaced endoplasmic reticulum (porgy) were noticed in the hepatic cells of Cd-administered fish. In the epithelial cells of the proximal segment of renal tubule of both fishes fed on Cd-containing feed the most remarkable alterations were increase and enlargement and losomes and apical vacuoles, increase of coated vesicles and apical tubules, and dilation of smooth-surfaced endoplasmic reticulum. These ultrastructural alterations in the liver and kidney are considered to be the effects of ingested Cd, and to imply functional disorders of both organs. (Deal-EIS)
W79-08277

MORTALITY OF EXPERIMENTALLY DESCALED SMOLTS OF COHO SALMON (ONCORHYNCHUS KISUTCH) IN FRESH AND SALT WATER,
Fish and Wildlife Service Seattle, WA.
For primary bibliographic entry see Field 5C.
W79-08279

MODEL OF RAPID DETECTION OF SUBLETHAL EFFECTS OF POLLUTANTS: MODIFICATION OF AMYLASE AND TRYPSIN LEVELS OF ARTEMIA SALINA CONTAMINATED BY COPPER OR ZINC, (IN FRENCH),
Centre National pour l'Exploitation des Oceans, Paris (France); and Centre Oceanologique de Bretagne, Brest (France).
A. M. Alayse-Danet, J. L. Charlou, M. Jezequel, and J. F. Samain.
Marine Biology, Vol. 51, p 41-46, 1979. 3 fig, 24 ref. (English Abstract).

Descriptors: *Enzymes, *Brine shrimp, *Inhibition, *Amylase, *Trypsin, *Tissue analysis, Growth rates, Animal metabolism, Animal physiology, Copper, Zinc, Water pollution effects, Bioindicators, Chemical analysis, Metals.

Variations in amylase and trypsin activities were studied in Artemia salina L. exposed to concentrations of copper or zinc which impair their growth. Disturbances in the levels of these enzymes were compared with decreases in growth rate. Amylase activity was disturbed within 24 h by 2 ppm copper and within 72 h by 5 ppm zinc. Inversely, trypsin activity was disturbed within 24 h by 5 ppm zinc and within 72 h by 2 ppm copper. Disturbances at the enzymatic level occurred more rapidly than decreases in growth rate, except for trypsin in A. salina polluted by copper. In the latter case, both were affected simultaneously. The possibility of growth disturbance by modified development of digestive enzymes is discussed. The possible use of enzymatic variation for rapid detection of sublethal effects of pollutants on aquatic organisms in situ is suggested. (Deal-EIS)
W79-08280

ECOLOGOBIOCHEMICAL CHARACTERISTICS OF HYDROCARBONS IN SOME MEDITERRANEAN SEA ORGANISMS,
Institute of Biology of Southern Seas, Sevastopol, (USSR).
T. L. Shchekaturina.
Hydrobiological Journal, Vol. 14, p 81-84, 1978. 1 fig, 1 tab, 12 ref. (Translated from Russian).

Descriptors: *Oil, *Oil pollution, Oil spills, *Monitoring, Chemical analysis, Benthos, Petroleum hydrocarbons, Mediterranean Sea, Sediments, *Molluscs, Mussels, Clams, Sea urchins, Normal alkanes, Chromatograms, Branched alkanes, Paraffinic hydrocarbons, Naphthenic hydrocarbons.

The qualitative and quantitative composition of some Mediterranean Sea organisms is investigated. The concentration of saturated hydrocarbons varies from 0.01 to 2 mg/100 g of wet weight.

With n-alkanes from C11 up to C19 and branched alkanes from iC14 to iC20 it is apparent that hydrocarbons of both artificial and natural origin are present. Aquatic organisms may be used as indicators of water pollution. (Katz-EIS)
W79-08282

USE OF MACROINVERTEBRATE LIFE HISTORY INFORMATION IN TOXICITY TESTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. L. Buikema, Jr., and E. F. Benfield.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 321-328, 1979. 68 ref.

Descriptors: *Methodology, Review, *Bioassays, *Toxicity, Benthos, Benthic fauna, Life history studies, Aquaculture, Laboratory tests, Animal physiology, Fish culture, Nutrient requirements, Animal behavior, Experimental design, *Invertebrates.

Life history information of macroinvertebrates is an important variable to consider when interpreting the results of toxicity tests. The importance of life history information has been recognized in the culturing of macroinvertebrates, but only in the last 5 yr has emphasis been placed on using this information in the design of acute and chronic toxicity tests. Sensitivity of organisms to toxicants is affected by nutrition, physiological requirements, behavior, predator-prey interactions, substrate, current, and light. There is need to integrate these, and other variables, to produce more defensible tests. Some features of life history may be used as end points in tests. (Katz-EIS)
W79-08285

SAMPLING STRATEGIES AND LIFE HISTORY OF NON-INSECTAN FRESHWATER INVERTEBRATES,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
D. F. Malley, and J. B. Reynolds.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 311-318, 1979. 1 tab, 46 ref.

Descriptors: *Methodology, *Benthos, Benthic fauna, *Invertebrates, Freshwater, Life cycles, Life history studies, Non-insect invertebrates, Crayfish, Opposum shrimp, Mysis, Oronectes, Juvenile growth stages, Sampling, Monitoring.

Life history of benthic freshwater invertebrates, excluding insects, may influence a number of features of sampling programs, such as the environment sampled, sampling technique or equipment used, frequency and timing of sampling, and mesh sizes of nets or sieves. Consideration of the life history should increase the effectiveness of the program and, in the extreme, may allow one to recognize artifacts that would otherwise lead to incorrect conclusions. Aspects of life history that influence sampling programs are (1) direct or indirect embyronic development and the extent to which young are sampled simultaneously with adults during the breeding season, (2) times of year when various developmental stages are present, (3) differences in size between various life stages necessitating use of more than one sampling method during the year, (4) change in habitat due to migrations or assumption of a pelagic, parasitic, or aerial existence for part of the life cycle, (5) change in mobility over the life cycle, (6) sex differences in size or behavior, and (7) adaptations to adverse conditions. Examples of ways in which life history affects sampling are based on the literature and on original data on the opposum shrimp, Mysis relicta, and the crayfish, Orconectes virilis. (KatZ-EIS)
W79-08286

IODINE BALANCE IN RAINBOW TROUT (SALMO GAIRDNERI) AND EFFECTS OF TESTOSTERONE PROPIONATE,
Manitoba Univ., Winnipeg. Dept. of Zoology.
D. W. C. Hunt, and J. G. Eales.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 282-285, 1979. 1 fig, 2 tab, 21 ref.

Descriptors: *Iodine, *Iodine balance, Rainbow trout, Animal physiology, Animal biochemistry, Iodide, Iodide flux, Fish foods, *Path of pollutants, Fish diets, Fish farming, Laboratory tests, Water pollution effects, Testosterone, Hormones.

Iodine balance was studied in immature rainbow trout held at 12 degrees C in water of iodine content 1.85 microgram/L and fed daily 1% of body weight with food containing 0.48 microgram I/g. Iodide flux into the plasma pool was 148 nannograms I per hour 100 grams of which < 1% was contributed by peripheral deiodination of thyroid hormones, up to 16% was obtained from the diet, and at least 84% was derived from the water. Less than 5% of iodide intake was required to satisfy thyroidal secretory demands. Testosterone injections elevated plasma iodide and protein levels, but did not alter the rate of plasma iodide turnover. (Katz-EIS)
W79-08287

THE DOMINANCE OF NANOPLANKTON AS AN INDICATOR OF MARINE POLLUTION: A CRITIQUE,
California Univ., San Diego. La Jolla. Inst. of Marine Resources.
R. W. Eppley, and C. S. Weiler.
Oceanologica Acta, Vol. 2, No. 2, p 241-245, 1979. 48 ref.

Descriptors: *Nanoplankton, *Dominant organisms, *Marine microorganisms, Phytoplankton, Eutrophication, Spatial distribution, Zooplankton, Food webs, Bioindicators, Trophic level, Ecosystems, Monitoring.

This is a brief review of the possible relationship between small-celled flagellated and coccoid phytoplankton and pollution. Examples are presented of the abundance of these forms in both pristine and polluted or eutrophied areas of the ocean. The natural distribution of these organisms is influenced also by water circulation patterns and food web interactions, including the grazing upon them by microzooplankton. Their dominance in the ocean at particular times and places cannot be inferred to reflect a result of pollution without other supporting evidence. (Deal-EIS)
W79-08288

MERCURY POLLUTION OF THE MARINE ENVIRONMENT IN THE REGION OF MARSEILLE, MEDITERRANEAN, FRANCE. PART 3-DEGREE OF CONTAMINATION BY MERCURY OF THE ECHINODERMS LIVING IN THE KELP BEDS IN THE VICINITY OF THE LARGE SEWER OF THE CITY OF MARSEILLES, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Sciences de la Mer et de l'Environment.
H. Augier, G. Gilles, and G. Ramonda.
Environmental Pollution, Vol. 18, p 179-185, 1979. 1 fig, 3 tab, 12 ref, (English summary).

Descriptors: *Mercury, *Tissue analysis, *Bioaccumulation, *Sea urchins, *France, Spectrophotometry, Chemical analysis, Chemical wastes, Animal metabolism, Industrial wastes, Heavy metals, Water pollution sources, Path of pollutants, Sea cucumbers.

Flameless atomic absorption spectrophotometry has been used to measure concentrations of mercury in Holothuria forskali and the sea-urchins Sphaerochinus granularis and Paracentrotus lividus in relation to depths of collection, size and the degree of pollution. The ranges of mercury (ppm) were 0.16-2.90 for H. forskali, 0.10-0.60 for P. lividus and 0.14-0.73 for S. granularis. The results show that the highest levels occur near the city of Marseilles adjacent to the main sewer. (Deal-EIS)
W79-08290

MEDICATION INHIBITS TOLERANCE TO SEAWATER IN COHO SALMON SMOLTS,
Fish & Wildlife Service, Seattle, WA.
For primary bibliographic entry see Field 5C.
W79-08295

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
J. R. Montgomery, and M. T. Price.
Environmental Science & Technology, Vol. 13, p 546-549, 1979. 2 fig, 3 tab, 13 ref.

Descriptors: Metals, *Cadmium, *Chromium, *Copper, *Nickel, *Lead, *Zinc, Laboratory tests, Marine algae, Sea urchin, Waste disposal, Sewage disposal, Sewage sludge, Turtle grass, *Mangrove ecosystem, Water pollution effects, Path of pollutants, Red mangrove, Clams, Oyster, Snails, Tidal marshes, Tropical regions.

This research was initiated to determine the rates of uptake, by a Thalassia testudinum mangrove ecosystem, over a 125-day period, of Cd, Cr, Cu, Ni, Pb, and Zn. The metals were leached from sewage sludge by flowing seawater (8.4 L/min) and subsequently traversed the model system. The largest net uptake of metals occurred in the 'fouling organisms' where Cd, Pb, and Zn uptake closely paralleled the net loss of metals from the sewage sludge. Thalassia leaves showed a net uptake for Cr, Pb, Ni, and Zn. The urchin Lytechnius variegatus, a grazer of Thalassia lves, also demonstrated a net uptake of Cu, Cr, Pb, Zn, and Ni. The sea cucumber Holothuria mexicana showed a net uptake of Cr, Cu, Pb, and Zn. Net uptake of metals was shown by the roots of the red mangrove Rhizophora mangle Linne. Because of insufficient sample mass, no consistent metal uptake was found for the clam Codakia orbicularis, oyster Crassostrea rhizophorae, or the snail Nerita tessellata. The results indicate that the dumping of sewage sludge in coastal tropical waters can lead to the uptake and concentration of toxic trace metals by members of a turtle grass community. (Katz-EIS)
W79-08296

ADSORPTION OF POLYCHLORINATED BIPHENYL ONTO SEA BED SEDIMENT, MARINE PLANKTON, AND OTHER ADSORBING AGENTS,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W79-08297

DEGRADATION OF DIAZINON BY SODIUM HYPOCHLORITE. CHEMISTRY AND AQUATIC TOXICITY,
Army Medical Bioengineering Research and Development Lab. Fort Detrick, MD.
W. H. Dennis, Jr., E. P. Meier, W. F. Randall, A. B. Rosencrance, and D. H Rosenblatt.
Environmental Science & Technology, Vol. 13, p 594-598, 1979. 113 ref.

Descriptors: *Toxicity, *Bioassay, Laboratory tests, Pesticides, *Insecticides, Waste disposal, Waste treatment, Degradation(Decomposition), Sunfish, Freshwater fish, Chlorinated aromatic hydrocarbons, Aromatic naphtha, Chemical disposal systems, *Diazinon, Minnows, Daphnia, Freshwater fish, Chemical analysis, Chemical reactions, Chemical wastes.

This study demonstrated that diazinon is rapidly degraded by sodium hypochlorite between pH 8 and 10. The sequence of reaction was determined and the two principal end products of the reaction were identified as acetic acid and isobutyramidinium trichloroacetate. Treatment with hypochlorite reduced the acute toxicity of diazinon dust formulations to bluegill by at least 3700-fold. Bioassay data indicated that a diazinon emulsifiable concentrate formulation retained considerable toxicity after treatment with sodium hypochlorite. The toxic components of the emulsifiable concentrate reaction mixture were identified as the heavy aromatic naphtha constituent of the formulation and the chlorinated aromatic hydrocarbons produced by the hypochlorite reaction. These components were almost as toxic as the diazinon formulation. A model approach emphasizing the need for bioassay data in development of chemical disposal systems is proposed and discussed. (Katz-EIS)

W79-08298

THE IMPORTANCE OF SALINITY IN DETERMINING THE MORPHOLOGY AND COMPOSITION OF ALGAL MATS,
North Carolina Univ. at Chapel Hill. Curriculum in Marine Sciences.
J. G. Sanders.
Botanica Marina, Vol. 22, p 159-162, 1979. 1 fig, 2 tab, 2 ref.

Descriptors: *Salinity, *Marine algae, North Carolina, Shackleford banks, Algae, *Plant groupings, Plant growth, Plant populations, Bioassays, Laboratory tests, Bluegreen algae, Green algae, Lyngbya, Algal composition, *Algal mat growth, Intertidal areas, Supertidal areas.

Three algal mats on Shackleford Banks, North Carolina, have different algal assemblages due to salinity differences in the underlying water table. Intertidal, saline mats are dominated by one species of Lyngbya, while supertidal mats are dominated by a mixture of blue-green and green algae. The salinity stress also effectively reduces species diversity in the intertidal mat; however, the daily tidal flushing of the mat allows more active growth. In laboratory experiments it was demonstrated that the intertidal mat grew best at 20% salinity and the supertidal mat grew best at 0% salinity. (Katz-EIS)
W79-08299

THE ROLE OF EFFLUENT MONITORING IN ENVIRONMENTAL CONTROL,
British Columbia Univ., Vancouver. Faculty of Commerce and Business Administration.
P. N. Nemetz, and H. D. Drechsler.
Water, Air and Soil Pollution, Vol. 10, p 477-497, 1978. 5 fig, 9 tab, 9 ref.

Descriptors: *Monitoring, Water pollution effects, Industrial wastes, Industrial plants, British Columbia, *Pulp wastes, Pulp and paper industry, Environmental control, Environmental engineering, Sampling, Composite sampling, Systems, *Monitoring practices.

Using effluent data from a British Columbia pulp mill, the authors demonstrate certain critical deficiencies associated with currently emplaced monitoring systems. The principal ingredient in effective environmental control is information, and current monitoring regimes entail an unacceptable level of information loss. Composite sampling systems fail to provide the two key types of information required for effective environmental control; (1) a high representational accuracy of the effluent profile; and (2) the detection of most or all pollutant releases with potentially serious environmental consequences. In light of these conclusions, the authors make several recommendations concerning current and alternative sampling regimes. (Katz-EIS)
W79-08307

HEAVY METALS IN RELATION TO THE BIOLOGY OF THE MUMMICHOG, FUNDULUS HETEROCLITUS,
Adelphi Univ., Garden City, NY. Dept. of Biology.
B. Chernoff, and J. K. Dooley.
Journal of Fish Biology, Vol. 14, p 309-328, 1979. 10 fig, 5 tab, 55 ref.

Descriptors: *Metals, *Cadmium, *Copper, *Mercury, *Manganese, *Zinc, Water pollution effects, Path of pollutants, Water chemistry, Tissue concentrations, Mummichog, Fundulus heteroclitus, Sex differences, Long Island, Long Island Sound, Great South Bay, Hempstead Harbor, Jamaica Bay, Bioconcentration.

Heavy metal levels of cadmium, copper, mercury, manganese, and zinc were examined in the mummichog, Fundulus heteroclitus, from industrialized and non-industrialized environments. With one exception, the environment with the highest trace metal in its waters, had the fishes with the highest metal concentration. Except for mercury the concentration factor varied inversely with the metal concentrations of the fish and water, suggesting a possible regulatory mechanism for metals in the tissues of mummichogs from environments with high metal concentrations. There was an inverse relationship between standard length and concentrations of zinc, manganese, copper and cadmium in whole male and female fishes. The viscera contained significantly greater concentrations of these metals than somatic muscle tissue. There were also significant differences between males and females with respect to whole-body zinc and copper concentrations, but no sex differences for manganese and cadmium. (Katz-EIS)
W79-08308

STRONTIUM MARKING OF HATCHERY-REARED COHO SALMON (ONCORHYNCHUS KISUTCH, WALBAUM),
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
S. B. Yamada, T. J. Mulligan, and S. J. Fairchild.
Journal of Fish Biology, Vol. 14, p 267-275, 1979. 1 fig, 5 tab, 6 ref.

Descriptors: *Salmon, Coho salmon, *Fish management, Fish hatcheries, Fish population, *Fish foods, *Strontium, *Calcium, Path of pollutants, Water pollution effects, Juvenile fish, Growth, Fisheries, *Fish marking, Fish identification.

This study examines the feasibility of marking fish tissue by substituting a biologically rare element, strontium, for calcium. Sixteen-month-old hatchery-reared coho salmon (Oncorhynchus kisutch) were fed a diet, to which 10,000 ppm stable strontium was added, for 60 days. Prior to their seaward migration in June 1976, the treated coho contained 32 times as much strontium in their vertebrae as did the control coho. Sixty-eight precocious males 'jacks' returned to the hatchery in the fall of 1976 and 1200 adults in the fall of 1977. Strontium-treated 'jacks' contained 1.4 times as much strontium as did control 'jacks' however, treated and untreated fish could not be distinguished as adults. The reduction in the strontium concentration of the treated fish could be accounted for by growth. (Katz-EIS)
W79-08310

A NOVEL BIOPSY TECHNIQUE FOR MONITORING ENVIRONMENTAL CONTAMINANTS IN FISH,
Queensland Dept. of Primary Industries, Brisbane (Australia).
D. C. Moy, and M. C. L. Dredge.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 35-37, 1979. 4 ref.

Descriptors: *Analytical techniques, *Mullets, *Biopsy, *Tissue analysis, Tagging, Marking techniques, Non-destructive tests, Research and development, Testing procedures, Mortality, Laboratory tests, On-site collections.

One of the major problems in detecting and monitoring pollutant chemicals in living organisms is the normally destructive nature of the sampling and testing. A needle biopsy and tagging technique is described. The technique requires three individuals to perform and takes 30 seconds per fish. No mortalities secondary to the procedure were observed in 30 fish during an aquarium trial. Work is continuing on the analytical methodology necessary to use the biopsy samples for pesticide monitoring. (Deal-EIS)
W79-08311

EFFECTS OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL ON THE MARINE ALGA, DUNALLIELA TERIOLECTA,
California Univ., Bodega Bay. Bodega Marine Lab.
P. Nunes, and P. E. Benville, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 727-732, 1979. 2 fig, 1 tab, 8 ref.

Descriptors: *Growth rates, *Oil, *Toxicity, *Marine algae, *Crude oil, *Dunalliela, Oil spills, Oil pollution, Organic compounds, Phytoplankton, Bioassay, Gas chromatography, Chemical analysis, Microbial degradation, Cook Inlet crude oil, Water soluble fraction.

Previous oil bioassays on phytoplankton report the combined effects of oil and oil dispersing agents. This study attempts to determine the effects of the water-soluble components of Cook Inlet crude oil on the marine alga, Dunalliela tertiolecta, without the addition of emulsifying agents. The results of this study indicate that low concentrations of the water-soluble fraction of crude oil have a stimulatory effect on the growth rate of this marine alga. (Deal-EIS)
W79-08313

UPTAKE AND DEPURATION OF PETROLEUM HYDROCARBONS IN THE MANILA CLAM, TAPES SEMIDECUSSATA REEVE,
California Univ., Bodega Bay. Bodega Marine Lab.
P. Nunes, and P. E. Benville, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 719-726, 1979. 1 fig, 1 tab, 19 ref.

Descriptors: *Clams, *Oil, *Animal metabolism, *Absorption, *Crude oil, *Tissue analysis, *Bioaccumulation, *Depuration, *Tapes, Chemical analysis, Organic compounds, Aromatic compounds, Water chemistry, Path of pollutants, Animal physiology, Commercial shellfish, Bioassay, Benzene, Toluene, Ethylbenzene, P-xylene, M-xylene, O-xylene.

Clams were exposed to a continuous-flow of the water-soluble fraction of Cook Inlet crude oil for eight days and the water and clam tissues analyzed for six monocyclic aromatics, namely, benzene, toluene, ethylbenzene, P-xylene, M-xylene, and O-xylene. Five of the monocyclics were found in the water and four of the monocyclics were found to have been accumulated by the clams. Benzene concentration was the highest in the water phase followed by toluene, M-xylene, O-xylene and ethylbenzene. The same order of concentration was observed in clam tissues except for benzene which our analytical method was unable to detect during uptake and depuration. (Deal-EIS)
W79-08314

THE IN VIVO EFFECT OF MERCURIC CHLORIDE ON SOME DIGESTIVE ENZYMES OF A FRESH WATER TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and P. K. Gupta.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 9-16, 1979. 2 tab, 29 ref.

Descriptors: *Enzymes, *Mercury, *Toxicity, *Channa, *Tissue analysis, Heavy metals, Chemical analysis, Path of pollutants, Chlorides, Digestion, Fish physiology, Animal metabolism, Inhibition, Biochemistry, Phosphatase.

Alterations in the activities of alkaline phosphatase, acid phosphatase, glucose-6-phosphatase amylase, trypsin, pepsin, aminotripeptidase, glycylglycine dipeptidase and carnosinase due to exposure of Channa punctatus to a sublethal concentration (0.30 mg/L) of mercuric chloride by bath for 20 days have been studied in the different parts of the digestive system. A fall in the activities of the three phosphatases was recorded except for alkaline phosphatase which showed a slight elevation in activity in intestine and pyloric caeca. An increase in the activity of amylase and the two proteases was observed in all the portions of the digestive system. The three peptidases revealed a decrease in activity. (Deal-EIS)
W79-08317

EFFECTS OF CALCIUM ADDITION AS CA(NO3)2 ON ZINC TOXICITY TO FATHEAD MINNOWS, PIMEPHALES PROMELAS, RAFINESQUE,
North Texas State Univ., Denton. Dept. of Bio-

logical Sciences.
R. D. Judy, Jr., and P. H. Davies.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 88-94, 1979. 2 fig, 3 tab, 14 ref.

Descriptors: *Zinc, *Calcium, *Toxicity, *Minnows, Metals, Mortality, Water chemistry, Lethal limit, Bioassay, Hardness(Water), Nitrates, Inhibition, Fish physiology.

The role Ca++ plays in the inhibition of Zn++ toxicity was examined in three experiments. First, minnows were treated with Zn++ alone to determine the 96-h LC50 (3.1 mg/L). Second, various levels of Ca(NO3)2 were added to 6.0 mg/L zinc levels. The addition of Ca++ inhibited zinc toxicity from 65% in soft tap water to 0% in 117.5 mg/L Ca++ water. Finally, more detailed studes of the definitive Ca++ levels needed to reduce mortality were performed. Definitive inhibition of Zn++ toxicity by Ca++ additions was shown as a graded response of mortality in all test tanks. (Deal-EIS)
W79-08318

A COMPARATIVE STUDY OF THE EFFECT OF ACUTE AND CHRONIC MERCURIC CHLORIDE TREATMENT ON THE ACTIVITIES OF A FEW DIGESTIVE ENZYMES OF A TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, P. K. Gupta, and P. V. Malik.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 28-34, 1979. 3 tab, 20 ref.

Descriptors: *Mercury, *Toxicity, *Enzymes, *Channa, *Tissue analysis, Heavy metals, Chemical analysis, Amino acids, Inhibition, Biochemistry chlorides, Teleosts, Fish physiology, Animal metabolism, Maltase, Lactase, Dipeptidase, Water pollution effects.

In this study a comparison of the effect of exposure of Channa punctatus to LC(50) (1.8 mg/L) and a sublethal concentration (0.30 mg/L) of mercuric chloride on the activities of maltase, lactase leucyl-L-glycine dipeptidase and lipase was performed. After 96 hr of treatment, a slight elevation in maltase activity was recorded in all the portions of the digestive syste. Lipase and leucyl-L-glycine dipeptidase showed inhibition in activity. Chronic treatment for 20 days revealed a significant inhibition in the activities of all the four enzymes. (Deal-EIS)
W79-08319

ALKANES IN FISH FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
B. S. Middleditch, E. S. Chang, B. Basile, and S. R. Missler.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 249-257, 1979. 1 fig, 1 tab, 10 ref.

Descriptors: *Oil, *Fish physiology, *Alkanes, *Tissue analysis, Path of pollutants, Oil pollution, Organic compounds, Offshore platforms, Bass, Catfish, Gas chromatography, Chemical analysis, Food chains, Aromatic compounds, Water pollution effects, Buccaneer oil field, Louisiana, Public health.

Twenty-five species of fish from the Buccaneer oilfield were examined for petroleum-derived alkanes. There was good evidence for petroleum alkanes in A. probatocephalus, C. spilopterus, C. arenarius, M. undulatus, P. saltatrix, P. porosissimus, P. rubio, S. brasiliensis, S. caprinus, S. papillosum, S. plagiusa, S. foetens, and U. floridanus. It was also possible that A. felis, C. faber, and O. pardus were contaminated, but there were no petroleum alkanes in the other nine species examined. Levels of petroleum alkanes were usually higher in livers than in muscle tissue. (Deal-EIS)
W79-08320

UPTAKE, TISSUE DISTRIBUTION, METABOLISM AND ELIMINATION N-OCTANO-1-14C-HYDROXAMIC ACID BY BROOK TROUT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
D. C. Darrow, and R. F. Addison.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 265-270, 1979. 1 tab, 12 ref.

Descriptors: *Absorption, *Brook trout, *Animal metabolism, *Fry, *Tissue analysis, *Bio accumulation, Organic compound, Acids, Fish physiology, Growth stages, Radioactivity techniques, Tracers, Path of pollutants, Biochemistry, Organic acids.

Brook trout fry rapidly accumulated and cleared a labelled medium chain length alklhydroxamic acid. Appreciable amounts of accumulated material were evidently converted to the corresponding carboxylic acid (whence they entered the normal metabolism of the animal via the lipoclastic cycle). The detoxification process (hydroxamate-carboxylate) evidently does not proceed sufficiently rapidly to offer complete protection to the fish, however, as in previous studies, OHA proved lethal to salmon fry. (Deal-EIS)
W79-08321

UPTAKE AND METABOLISM OF SELENIUM BY OYSTERS,
Southhampton Univ. (England). Dept. of Oceanography.
J. J. Wrench.
Marine Science Communications, Vol. 5, No. 1, p 47-59, 1979. 2 fig, 2 tab, 12 ref.

Descriptors: *Oyster, *Animal metabolism, *Absorption, *Selenium, *Tissue analysis, *Bioaccumulation, Metals, Amino acids, Proteins, Biochemistry, Enzymes, Chemical analysis, Path of pollutants, Phytoplankton, Commercial shellfish, Bacteria.

Observation of the equilibration of 75Se with the tissues of Ostrea edulis suggested that the highest concentration factor occurred in the digestive gland. A study of the form of selenium in this tissue after assimulation of 75Se from water or labelled phytoplankton showed that the majority of selenium, in both cases, was strongly associated with protein. Enzymic hydrolysis of protein and subsequent chromatography of hydrolytic products revealed the presence of breakdown products of selenium analogues of the common sulphur amino acids. (Deal-EIS)
W79-08322

EFFECTS OF LEAD NITRATE ON THE ACTIVITIES OF A FEW ENZYMES IN THE KIDNEY AND OVARY OF HETEROPNEUSTES FOSSILIS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and M. K. Agrawal.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 55-59, 1979. 1 tab, 22 ref.

Descriptors: *Lead, *Toxicity, *Enzymes, *Channa, *Tissue analysis, Heavy metals, Chemical analysis, Inhibition, Fish physiology, Animal metabolism, Teleosts, Biochemistry, Nitrates, Water pollution effects, Kidney, Phosphatase, Lipase, Urease, Animal pathology.

The effect of LC(50) and a sublethal concentration of lead nitrate on the activities of alkaline phosphatase, acid phosphatase, glucose-6-phosphatase, lipase and urease in the kidneys and ovaries of a teleost fish, Channa punctatus has been examined after 96 hr and 30 days, respectively. The results show that all five enzymes in the two tissues are inhibited significantly at both the experimental stages. However, the inhibition produced after 30 days by the sublethal concentration is higher, indicating the cumulative action of lead. Further, the inhibition of enzymes is more marked in kidney than in the ovary. (Deal-EIS)
W79-08324

ACCUMULATION OF POLYCHLORINATED BIPHENYL (PHENOCLOR DP6) BY ESTUARINE FISH,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
J. F. Narbonne.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 60-64, 1979. 3 tab, 17 ref.

Descriptors: *Polychlorinated biphenyls, *Fish physiology, *Mullets, *Tissue analysis, *Bioaccumulation, Path of pollutants, Chemical analysis, Juvenile growth stage, Industrial wastes, Water chemistry, Gas chromatography, Animal metabolism, Organic compounds, Phenoclor DP6, Liver, Tissue concentration.

The purpose of this study was to measure the concentration coefficient and the tissue distribution of a French PCB (Phenoclor DP6) from water and from food in juvenile grey mullets (Chelon labrosus). Fish intoxicated for 30 days by Phenoclor DP6 added either to water or food revealed an accumulation of PCB in all tissues measured. The highest concentration was found in the liver. There was a higher accumulation of PCB from water than from food. Little or no Phenoclor DP6 was metabolized by these fish. The results provide important data on the PCB accumulation in food chains. (Deal-EIS)
W79-08325

EFFECTS OF CRUDE AND DIESEL OIL SPILLS ON PLANT COMMUNITIES AT PRUDHOE BAY, ALASKA, AND THE DERIVATION OF OIL SPILL SENSITIVITY MAPS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 5C.
W79-08326

POLYCHLORINATED BIPHENYL ACCUMULATION IN GREY MULLETS (CHELON LABROSUS): EFFECT OF AGE,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
J. F. Narbonne.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 65-68, 1979. 1 fig, 2 tab, 9 ref.

Descriptors: *Polychlorinated biphenyls, *Mullets, *Age, *Tissue analysis, *Bioaccumulation, Path of pollutants, Fish physiology, Animal metabolism, Chemical analysis, Gas chromatography, Pesticide residues, Organic compounds, Chlorinated hydrocarbon pesticides.

Twelve mullets 2.5 years old and 12 mullets 3.5 years old were fed a dry fish diet (AQUALIM) contaminated by DP6 to a concentration of 50 micrograms/g. Groups of 4 fishes were sacrificed after 8, 15 and 30 days of DP6 ingestion and analyzed by gas chromatography. The relative peaks heights of individual DP6 isomers in the chromatogram did not vary with the age of the fish. This would indicate that there is no selective metabolism of specific DP6 components in mullets. The DP6 ingested by the fish was stored in carcass according to a logarithmic curve independent of age. However, the DP6 concentration in carcass appeared higher in older fishes than in young fishes. This would indicate that PCB concentration in fish is dependent on food intake. (Deal-EIS)
W79-08327

ACUTE TOXICITY OF CADMIUM, COPPER, AND MERCURY TO LARVAL AMERICAN LOBSTER HOMARUS AMERICANUS,
Environmental Research Lab., Narragansett, RI.
M. W. Johnson, and J. H. Gentile.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 258-264, 1979. 1 fig, 24 ref.

Descriptors: *Larval growth stage, *Toxicity, *Cadmium, *Mercury, *Copper, Lobsters, Mortality, Growth stages, Heavy metals, Crustaceans, Commercial shellfish, Bioassay, Municipal wastes, Industrial wastes, Path of pollutants, Homarus.

Stage 1 lobster larvae were exposed to several concentrations of cadmium, copper and mercury. The 96 hr LC-50 values were 78, 48, and 20 micrograms/L, respectively. Comparison with data on copper toxicity to adults reveals an elevated sensitivity in larvae (2X). No comparable data exist for the acute effects of mercury or cadmium on adults. In view of the heightened sensitivity in larvae it was proposed that this growth stage be employed in future toxicity testing. (Deal-EIS)
W79-08328

SPATIAL AND TEMPORAL DYANAMICS OF BACTERIAL PHOTOSYNTHETIC POPULATIONS IN AN ANAEROBIC POND OF SULFUROUS WATER, DINAMICA ESPACIOTEMPORAL DE LAS POBLACIONES BACTERIANAS FOTOSINETICAS EN UNA LAGUNA ANAEROBIA DE AGUAS SULFUROSAS,
Barcelona Univ. (Spain). Dept. of de Microbiologia.
R. Guerrero, and C. Abella.
Oecologia Aquatica, Vol. 3, p 193-205, 1978. 12 fig, 3 tab, 18 ref. (English Summary).

Descriptors: *Phytoplankton, *Photosynthesis, *Bacteria, Freshwater bacteria, *Ponds, *Anaerobic ponds, Anaerobic bacteria, Anaerobic conditions, *Hydrogen sulfide, Chemical analysis, Chromatium, Chlorobium, Food chain, Sulfur bacteria, Sulfur compounds, Sulfides, Baynoles Lake, Spain.

The Siso pond is a small eutrophic water body located near Banyoles Lake (Gerona, Spain), and a part of the same karstic system. The evolution of the photosynehetic bacterial population, composed mainly by Chromatium violascens, clorobium limicola and Chlorobium phaeovibrioides, has been followed. The two genera present different strategies: Chromatium is able of active motion and can move in search of its H2S optimum; Chlorobium is immotile and adaptates itself to a broader range of H2S concentration and ilumination. Therefore, Chromatium is the dominant bacteria in the Siso pond when the H2S concentration is between 20 and 40 mg/1; it reaches the surface in winter time (January-February), when the illumination is low. Correspondingly, Chlorobium is the dominant bacteria when the H2S concentration is over 50 mg/1 and reaches the surface in summer and fall time. Thus, the chemical compound which determines the bacterial population composition is sulfide; its concentration depends on other factors, as sulfate and temperature, and its vertical distribution on the stational thermal structure. (Katz-EIS)
W79-08329

MASS DEVELOPMENT OF THE PHYTOFLAGELLATE PRYMMESIUM PARVUM CARTER (HAPTOPHYCEAE) IN A COASTAL LAGOON IN THE EBRO DELTA (DESARROLLO MASIVO DEL FITOFLAGELADO PRYMNESIUM PARVUM CARTER (HAPTOPHYCEAE) EN UNA LAGUNA COSTERA DEL DELTA DEL EBRO),
Barcelona Univ. (Spain). Dept. de Ecologia.
F. A. Comin, and X. Ferrer.
Oecologia Aquatica, Vol. 3, p 207-210, 1978. 1 fig, 1 tab, 22 ref. (English summary).

Descriptors: *Phytoplankton, *Mortality, *Toxicity, *Fish kill, *Toxic algae, Phytoflagellate, *Prymnesium parvum, Ebro delta, Spain, Water quality, Water chemistry, Nutrients.

The mass development of the toxic alga Prymnesium parvum Carter (2 x 10 to the 8th power cells/l) caused on a large scale the death of fish in a coastal lagoon in the Ebro Delta. The water acquired a chocolate-red colour for two months (November and December 1977). This situation occurred after the entrance of great quantities of sea water, driven by the wind. Data on the chemical parameters of the water and on the species composition of the phytoplankton are listed. (Katz-EIS)
W79-08330

TOXICITY OF PRUDHOE BAY CRUDE OIL TO ALSKAN ARCTIC ZOOPLANKTON,
Kansas Univ., Lawrence. Dept. of Systematics and Ecology.
For primary bibliographic entry see Field 5C.
W79-08331

HYDROCARBONS AND MICROBIAL ACTIVITIES IN SEDIMENT OF AN ARCTIC LAKE ONE YEAR AFTER CONTAMINATION WITH LEAD GASOLINE,
Louisville Univ., KY. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-08333

CRUDE OIL BIODEGRADATION IN ARCTIC TUNDRA PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W79-08334

EFFECT OF PETROLEUM HYDROCARBONS ON MICROBIAL POPULATIONS IN AN ARCTIC LAKE,
Marine Biological Lab. Woods Hole, MA. Ecosystems Center.
M. J. Jordan, J. E. Hobbie, and B. J. Peterson.
Arctic, Vol. 31, p 170-179, 1978. 1 fig, 5 tab, 17 ref.

Descriptors: *Oil, *Oil spills, Water pollution effects, *Alaska, Prudhoe Bay, Bacteria, Degradation(Decomposition), *Arctic, Lakes, Microbiology, Microorganisms, Water chemistry, Sediments, Petroleum hydrocarbons, Methodology, Carbon radioisotopes, Carbon 14, Laboratory tests, Oil lake.

A sea-curtain enclosed section of a lake 240 mk south of Prudhoe Bay, Alaska was exposed to Prudhoe crude oil in July 1976. One year following exposure to the oil, no significant differences were detected between the waters or sediments of the oiled versus control area in rates of turnover of glucose. Total numbers of bacteria were slightly higher in oiled than in control waters. There were no differences in numbers of sediment bacteria. Rates of uptake of hexadecane and napthalene by sediment microbes were not linear with time. Hexadecane was taken up sooner and faster than was napthalene. In some incubations, significantly (88-95% probability level) greater rates of hydrocarbon uptake were measured for oiled than for control sediments. Only incorporated, not mineralized, hydrocarbons were measured due to methodological problems. Several methods of using 14C-labelled hydrocarbons in a field situation are presented. (Katz-EIS)
W79-08335

LETHAL EFFECT OF GYMNODINIUM SP. ON THE ROTIFER, BRACHIONUS PLICATILIS (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
T. Abe, and K. Hirayama.
Bulletin of the Faculty of Fisheries Nagasaki University, No. 46, p 1-6, 1979. 4 fig, 1 tab, 9 ref. (English summary).

Descriptors: *Red tide, *Gymnodinium, *Toxicity, *Rotifers, Phytoplankton, Mortality, Aquatic animals, Cytological studies, Growth rates, Lethal limit, Water chemistry, Growth stages, Bioassay, Public health, Bioassay.

Gymnodinium sp. (tentatively named as G. type '65) is a main causative organism of red tides occurring frequently at Omura Bay since 1965. However, the toxicity of this species to aquatic animals has still remained doubtful. This study demonstrates the lethal effect of G. type '65 on the rotifer, Brachionus plicatilis. Culture of G. type '65 displayed the lethal effect on the rotifer more fetal in exponential growth stage (24-hr. Tlm: 3.3 cells/ml) than in stationaly stage (24-hr. Tlm: 195 cells/ml). If the living cells were filtered out or destroyed by ultrasonics, the suspension of G. type '65 even at the high concentration of 8 approx. 10 X 10000 cells/ml completely lost the lethal ability to the rotifer. These facts indicate that the existence of living cells is strictly essential for G. type '65 to display the lethal effect on the rotifer. (Deal-EIS)
W79-08336

RUNOFF WATER QUALITY FROM VARYING LAND USES IN SOUTHEASTERN ARIZONA,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
H. A. Schreiber, and K. G. Renard.
Journal of Range Management, Vol. 31, No. 4, p 274-279, July 1978, 5 fig, 2 tab, 15 ref.

Descriptors: *Runoff, *Surface waters, *Water pollution sources, *Water pollution effects, *Environmental effects, Water quality, Water pollution control, Suspended solids, Urbanization, Grazing, Calcareous soils, Dissolved solids, Phosphates, Nitrates, Range management, Soil-water-plant relationships, Arizona, Land use.

Although the collection of water quality data has become a necessity under the 1972 Federal Water Pollution Control Act Amendments and in the preparation of environmental impact statements, such information is often lacking, especially the impact of grazing on the chemical constituents of runoff water. This study seeks to identify and control sources of non-point pollution by collection of surface runoff samples from ungrazed brush-covered rangelands, recently subdivided rangeland still partly brush-covered but disturbed by urbanization, and grass-covered grazed rangeland at the Walnut Gulch Experimental Watershed near Tombstone, Arizona. Results indicated that despite the effects of grazing, the urbanized watersheds had poorer quality water, suggesting that the non-agricultural activities associated with housing development are more detrimental to water quality than those associated with undisturbed or grazed rangelands. Contrasts between the geology of grass and brush areas suggest that mineral sources affect the qualitative changes in dissolved solids. Calcareous soils were found to produce higher Ca and total dissolved solids, while phosphate concentrations were higher in the grass covered non-calcareous watersheds than in the brush-covered calcareous watersheds. The authors believe that phosphate may have its origins in the soil rather than from grazing while nitrate levels, found to increase in runoff from semi-urban areas, are a consequence of human urbanization. (Tickes-Arizona)
W79-08372

TRACE METALS AND MARINE PRODUCTION PROCESSES. PROCEEDINGS OF A WORKSHOP HELD AT THE PACIFIC MARINE ENVIRONMENTAL LABORATORY FEBRUARY 28 - MARCH 2, 1978,
National Ocean and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5C.
W79-08381

BACTERIA CRITERIA,
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 457, Price codes: A02 in paper copy, A01 in microfiche. April 1972. 18 p.

Descriptors: *Water quality control, *Water pollution, *Bacteria, Water pollution control, Recreation, Fishing, Potable water, Shellfish, Boating, Wastes.

The water quality standards program is directed by the Environmental Protection Agency, which has responsibility for approving state-adopted standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance. The first nationwide strategy for water quality management standards contain four major elements: (1) the uses (recreational, drinking, fish and wildlife propogation, industrial or agricultural) to be made of the interstate water; (2) criteria to protect those uses; (3) implementation plans (for needed industrial-municipal waste treatment improvements) and enforcement plans; and (4) an antidegradation statement to protect existing high quality water. State-adopted bacteria criteria for

the individual waters of each state are surveyed. (Vloedman-Florida)
W79-08403

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 4C.
W79-08425

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 352, Price codes: A02 in paper copy, A01 in microfiche. September 2, 1971, 13 p.

Descriptors: *State governments, *Water quality control, *Water quality standards, *Water pollution, Water pollution control, Standards, Streamflow, Aquatic animals, Barriers, Aquatic microbiology, Plankton.

The Water Quality Standards Division, Environmental Protection Agency has responsibility for approving State-adopted standards, evaluating adherence to the standards, and overseeing enforcement of standards compliance. This first nationwide strategy for water quality management standards contains four major elements: (1) the use (recreational, drinking, fish and wildlife propogation, industrial or agricultural) to be made of interstate water; (2) criteria to protect those uses; (3) implementation and enforcement plans (for needed industrial-municipal waste treatment improvements); and (4) an antidegradation statement to protect existing high quality waters. State-adopted standards for mixing zones are surveyed. Mixing zones are areas, unavoidably and harmfully polluted, used for mixing of discharged waters with receiving waters. They have defined and identifiable limits. The waters outside the zones must meet the standards for that particular body of water when several mixing zones are located close together. The Water Quality Criteria report recommends that they lie on the same side of the stream, to allow a continuous passageway for aquatic organisms on the opposite side. (Vloedman-Florida)
W79-08428

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX L--WATER POLLUTION CONTROL,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 764, Price codes: A07 in paper copy, A01 in microfiche. Chaired by Federal Water Pollution Control Administration, 1969. 114 p, 12 tab, 9 fig, 4 maps, 27 photos.

Descriptors: Water pollution, *Water quality, *Water pollution control, *Water quality control, Oregon, Water pollution abatement, Heated water, Thermal pollution, Water pollution treatment, Planning, Water treatment, Water pollution sources, Water pollution effects, Standards, Toxicity, Sediments, Dissolved solids, Bacteria, Organic wastes, River basins, River basin development, Flow abatement, *Willamette River(OR).

This study was taken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. This Appendix L--of the functional appendices is based on data contained in the three supporting appendices, A through C. Its objective is to appraise the existing level of water quality and to present recommendations for the restoration and maintenance of a proper level of water quality in the basin. Included are the identification of water and land-use practices adversely impacting water quality and suggestions to reduce such impacts; the determination of effluent standards for various sources; and the determination to regulate streamflow, especially as applied to water quality. Primary and secondary pollutional effects are outlined; factors considered include organic waste, heat, bacteria, toxics, sediments and dissolved solids. Present status of water quality is assessed by reviewing sources of pollution, evaluation factors, and water quality requirements and objectives. Each subbasin is discussed. Future demands are projected using waste projections from principal sources. Lastly, alternative solutions for providing water quality suitable for specific uses are presented. The combinations developed to meet 1980 goals are relatively specific; those combinations developed to meet and waste loads for 2000 and 2020 are progressively less specific but are adequate for long-range planning. (See also W79-08433) (Zayac-NC)
W79-08445

CADMIUM BIOACCUMULATION ASSAYS. THEIR RELATIONSHIP TO VARIOUS IONIC EQUILIBRIA IN LAKE SUPERIOR WATER,
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-08450

THE STRUCTURE OF MEIOFAUNA COMMUNITIES,
Oslo Univ. (Norway). Inst. for Marine Biology.
J. S. Gray.
Sarsia, Vol. 64, No. 4, p 265-272, 1978. 4 fig, 4 tab, 25 ref.

Descriptors: Benthos, *Benthic fauna, *Meiofauna, Kelps, Marine algae, *Methodology, Water pollution effects, England, Coasts, Animal groupings, Animal populations, Diversification, *Diversity, Marine Meiofauna communities, Diversity index, Nematodes, Evenness values, Water pollution effects.

Individuals and species of meiofauna from kelp holdfast along the north-east coast of England fitted both a logarithmic series and a log-normal model using data from unpolluted sites. At a polluted site the fit was generally less good to both models. In general, however, the log-normal was a closer fit to the observed data than the log-series, as has been found in other marine data. Using a neutral model, which eliminates the influence of biological interaction, diversity was found to be higher than predicted in meiofauna from kelp holdfasts and in Gastrotricha from sand beaches in eastern U.S.A. At a polluted site and with data for nematodes from an unpolluted site, diversity was not significantly different from neutral model predictions, but evenness was significantly lower Unlike terrestrial ecosystems therefore, biological interactions lead to higher diversity values in marine meiofaunal communities than neutral model predictions. Pollution has the effect of increasing dominance and thus lowering diversity values to neutral model predictions. (Katz-EIS)
W79-08451

IMPINGEMENT SAMPLING FREQUENCY. A MULTIPLE POPULATION APPROACH,
Lawler, Matusky, and Skelly, Tappan, NY.
F. M. El-Shamy.
Environmental Science & Technology, Vol. 13, No. 3, p 315-320, 1979. 6 tab, 6 ref.

Descriptors: *Methodology, Juvenile fish, Fish behavior, Mortalities, Fish kills, Power plants, Cooling, Cooling water, Monitoring, Sampling, Lake Ontario, Nine Mile Point Nuclear Station Unit 1, New York, Scriba, Fresh water fish, Smelts, Bass, Alewife, *Impingement, *Impingent sampling frequency.

Two years of impingement data were analyzed to design a sampling program based on the optimum allocation method. The method was applied to all species combined and then separately to each species. By sampling most intensively during months of peak fish abundance, a more precise estimate of yearly impingement rate is possible than when sampling was evenly distributed throughout the year. A 25% reduction in the current annual sampling program, when reallocated, decreased the width of 95% confidence intervals for the mean number of fish impinged daily. This width decreased from the original plus or minus 15.8% to plus or minus 4% for all fish combined, from plus or minus 32% to plus or minus 7% for alewife, from plus or minus 41% to plus or minus 17% for white perch, and from plus or minus 16% to plus or minus 11% for rainbow smelt. An improvement in precision of estimation was also predicted for other species. The analyses presented here suggest that, for each representative species, a different sampling scheme is necessary unless the 'species of interest' concept is ignored. (Katz-EIS)
W79-08452

DETERMINATION OF SEVERAL INDUSTRIAL AROMATIC AMINES IN FISH,
Food and Drug Administration Washington, DC. Div. of Chemical Technology.
G. W. Diachenko.
Environmental Science & Technology, Vol. 13, No. 3, p 329-333, 1979. 3 fig, 3 tab, 20 ref.

Descriptors: *Methodology, *Chemical analysis, Freshwater fish, Water pollution effects, *Buffalo River, *Delaware River, New York, New Jersey, Gram chromatography, Minnows, Carp, Path of pollutants, Public health, Aromatic compounds, *Aromatic amines, Chemical wastes, Dyestuffs.

A procedure is described for the determination of selected industrial aromatic amines in fish. Ground fish tissue is digested with aqueous sodium hydroxide and extracted with benzene. The extract is washed with dilute acid and cleaned up using gel permeation chromatography. The amines are separated and quantitated using nitrogen-selective gas-liquid chromatography. Recoveries of N-ethyl-N-phenyl-benzylamine, N-ethyl-N-(m-tolyl)benzylamine, N,N-dibenzylmethylamine, diphenylamine, and N-phenyl-1-naphthylamine from fish tissue fortified at levels of 20-100 ppb (micrograms per kilogram) averaged at least 80%. Recoveries of 1-naphthylamine and 3,3'-dichlorobenzidine were somewhat lower Fish samples obtained from rivers near nine textile and dyestuff manufacturers known to use certain aromatic amines have been analyzed. 1-Naphthylamine was detected in fish from the Buffalo and Delaware Rivers downstream from two dyestuff manufacturers. N-Ethyl-N-phenylbenzylamine and N-ethyl-N(m-toyl)benzylamine were also detected in the Buffalo River fish. (Katz-EIS)
W79-08453

THE RECOVERY AND HEMATOLOGICAL REHABILITATION OF CHLORINE STRESSED ADULT RAINBOW TROUT (SALMO GAIRDNERI),
Consumers Power Co., Jackson, MI. Dept. of Environmental Services.
For primary bibliographic entry see Field 5C.
W79-08454

LONG-TERM EFFECTS OF ZINC EXPOSURES ON BROOK TROUT (SALVELINUS FONTINALIS),
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-08455

ARSENIC CONCENTRATIONS IN WATER AND FISH FROM CHAUTAUQUA LAKE, NEW YORK,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
R. E. Foley, J. R. Spotila, J. P Geisy, and C. H. Wall.
Environmental Biology of Fish, Vol. 3, No. 4, p 361-367, 1978. 2 fig, 2 tab, 27 ref.

Descriptors: *Arsenic compounds, Arsenicals(Pesticides), Chautauqua Lake, New York, Herbicides, *Sodium arsenite, Lakes, Lake water, *Public health, Perch, Crappies, Muskellunge, Water pollution effects, Path of pollutants, Bass.

Arsenic persists in Chautauqua Lake, New York waters 13 years after cessation of herbicide (sodium arsenite) application and continues to cycle within the lake. Arsenic concentrations in lake water ranged from 22.4-114.8 micrograms per liter .x = 49.0 micrograms per liter. Well water samples generally contained less than 10 micrograms per liter arsenic. Arsenic concentrations in lake water exceeded U.S. Public Health Service recommended maximum concentrations (10 micrograms per liter) and many samples exceeded the maximum permissible limit (50 micrograms per liter). Fish accumulated arsenic from water but did not magnify it. Fish to water arsenic ratios ranged from 0.4-41.6. Black crappie (Pomois nigromaculatus) contained the highest arsenic concentrations (0.14-2.04 micrograms per liter, x = 0.7 micrograms per liter), perch (Perca flavescens), muskellunge (Esox masquinongy) and large-mouth bass (Micropterus salmoides) contained the lowest concentrations (0.02-0.13 micrograms per liter). Arsenic concentrations in fish do not appear to pose a health hazard for human consumers. (Katz-EIS)
W79-08456

EFFECTS OF ALDRIN EXPOSURE ON SNOW GEESE IN TEXAS RICE FIELDS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
For primary bibliographic entry see Field 5C.
W79-08458

EFFECT OF L-DOPA, BROMOCRIPTON AND LERGOTRILE ON PROLACTIN CELL ACTIVITY AND HYDROMINERAL REGULATION IN YEARLING COHO SALMON, ONCORHYNCHUS KISUTCH,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-08459

AN ATTEMPT TO COMBINE A BIOLOGICAL PURIFICATION OF MUNICIPAL SEWAGES WITH THEIR UTILIZATION IN FISHERIES, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
For primary bibliographic entry see Field 5C.
W79-08463

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
For primary bibliographic entry see Field 5C.
W79-08465

THE EFFECTS OF OIL SPILLS ON PHYTOPLANKTON IN AN ARCTIC LAKE AND PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W79-08466

5B. Sources Of Pollution

RELIABILITY OF AQUATIC INSECTS VERSUS WATER SAMPLES AS MEASURES OF AQUATIC LEAD POLLUTION,
Colorado Div. of Wildlife, Montrose.
For primary bibliographic entry see Field 5A.
W79-08036

FATE AND EFFECTS OF CADMIUM IN AN EXPERIMENTAL MARINE ECOSYSTEM,
Biologische Anstalt Helgoland, Hamburg (Germany, F. R.).
For primary bibliographic entry see Field 5A.
W79-08037

DETERMINATION OF THE ABSORPTION OF CR+6 AND CR+3 IN AN ALGAL CULTURE OF CHLORELLA PYRENOIDOSA USING 51CR,
Roskilde Univ. Center (Denmark). Inst. for Environment, Technology and Society.
For primary bibliographic entry see Field 5A.
W79-08038

INVESTIGATION ON THE DISTRIBUTION OF DDT AND AROCLOR 1254 IN LABORATORY-GROWN MARINE PHYTOPLANKTON,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5A.
W79-08039

MOBILIZATION AND ACCUMULATION OF SEDIMENT BOUND HEAVY METALS BY ALGAE,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08040

EFFECTS OF HEAVY METALS ON BENTHIC MACROINVERTEBRATE DENSITIES IN FOUNDRY COVE ON THE HUDSON RIVER,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 5A.
W79-08042

ACUTE TOXICITY OF COPPER, CHROMATE, ZINC, AND CYANIDE TO FRESHWATER FISH: EFFECT OF DIFFERENT TEMPERATURES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
M. J. Smith, and A. G. Heath.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 113-119, 1979. 2 fig, 2 tab, 10 ref.

Descriptors: *Bioassay, *Water temperature, *Toxicity, *Cyanide, *Chromate, Copper, Zinc, Metals, Rainbow trout, Channel catfish, Sunfishes, Shiners, Fish physiology, Mortality, Freshwater fish, Laboratory tests, Bioassays.

24-h bioassay tests were used to determine the lethal concentrations to freshwater fish of potassium cyanide, copper sulfate, zinc sulfate and potassium dichromate at three temperatures (5, 15, 30 degrees C). Young of rainbow trout, golden shiner, bluegill, goldfish and channel catfish were used. Temperature had a considerable effect on cyanide and chromate toxicity to goldfish, less effect in golden shiners, and none with the other species tested. There was a tendency for zinc to be more toxic at the higher temperatures to goldfish and bluegill, but not to shiners or trout. As for copper, there was a tendency toward a higher sensitivity at the higher temperatures in goldfish, channel catfish, and trout but the converse was seen in bluegill. (Deal-EIS)
W79-08043

TOXIC SUBSTANCES IN THE EFFLUENTS OF PETROCHEMICAL PLANTS AND THEIR EFFECT ON AQUATIC ORGANISMS (REVIEW),
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
Ya. M. Grushko, O. M. Kozhova, and L. M. Mamontova.
Hydrobiological Journal, Vol. 14, No. 2, p 47-51, 1978. 52 ref.

Descriptors: *Toxicity, *Water quality standards, *Chemical wastes, Industrial wastes, Commercial fishing, Water quality control, Waste water treatment, Organic compounds, Metals, Daphnia, Water chemistry, Biodegradation, Microbial degradation, Aromatic compounds, Waste water disposal.

The literature on toxicity of the components of petrochemical effluents reviewed. It is shown that the toxic concentrations of many compounds are considerably lower than the maximum concentrations of petroleum products stipulated for waters utilized by the fishing industry. It is concluded that it is essential to dilute waste-waters (including those that have undergone multistage purification) before discharging them, to establish standards governing the entry of individual components of wastewaters into surface waters, and to conduct further investigations on the microbiological breakdown of residual petroleum products in surface waters. (Deal-EIS)
W79-08045

ALTERATIONS IN CALCIUM ACCUMULATION BEHAVIOR IN RESPONSE TO CALCIUM AVAILABILITY AND POLYCHLORINATED BIPHENYL ADMINISTRATION,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
W. I. Hatch, and D. W. Allen.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 172-174, 1979. 1 tab, 5 ref.

Descriptors: *Polychlorinated biphenyl, *Snails, *Pesticide toxicity, *Cepeae, Aroclors, Animal behavior, Calcium, Animal physiology, Animal metabolism, Toxicity, Calcium carbonate, Water pollution effects.

The snail Cepeae nemoralis has been frequently observed rasping at the shells of conspecifics in areas of their distribution which were low in lime. This experiment examined the effects of PCBs upon calcium accumulation as a reflection of alterations in calcium appetitive behavior. Three groups of snails were tested. One group received a calcium abundant diet, one a calcium deficient diet and the third a calcium abundant diet with PCBs (Aroclors) added. Among snails receiving the calcium-abundant diet, damage was produced in 3% of the study population and penetration did not occur. In the calcium deficient group, however, damage was produced by 97% of the snails with 9% resulting in penetration. Administration of PCBs in food resulted in increased shell abrasion at all doses tested. In response to increasing amounts of the PCB mixture, penetration also increased, though not in a linear fashion. (Deal-EIS)
W79-08046

BROWN PELICAN: POPULATION STATUS, REPRODUCTIVE SUCCESS AND ORGANOCHLORINE RESIDUES IN LOUISIANA, 1971-1976,
Fish and Wildlife Service, Corvallis, OR. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W79-08047

CLEARANCE OF ARSENIC INGESTED BY MAN FROM ARSENIC CONTAMINATED FISH,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08049

POSSIBLE ACCUMULATION OF HEAVY METALS AROUND OFFSHORE OIL PRODUCTION FACILITIES IN THE BEAUFORT SEA,
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
T. K. Newbury.
Arctic, Vol. 32, No. 1, p 42-45, 1979. 1 fig, 13 ref.

Descriptors: *Heavy metals, *Path of pollutants, *Bottom sediments, *Bioaccumulation, Beaufort Sea, Offshore platforms, Alaska, Oil, Chromium, Zinc, Cadmium, Lead, Food chains, Food webs, Benthic fauna, Isopods, Amphipoda.

The heavy metals chromium, zinc, cadmium and lead have accumulated in the sediments around some offshore oil rigs. Oil production is now being considered for some nearshore sections of the Beaufort Sea coast. During winter in the Beaufort Sea, heavy metals in the sediments will not be dispersed; the under-ice currents are slow, and some of the bottom is covered by very saline, relatively stagnant water. Heavy metals in the sedi-

ments can probably be assimilated by epibenthic animals in the nearshore region, and then transferred through the food chain to natives who partially subsist on marine animals. (Deal-EIS)
W79-08050

THE ACCUMULATION OF HEAVY METALS IN THE SUBMERGED PLANT (ELODEA NUTTALLII),
Kanagawa Prefectural Environmental Control Center, Yokohama (Japan).
M. Nakada, K. Fukaya, S. Takeshita, and Y. Wada.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 21-27, 1979. 4 tab, 3 ref.

Descriptors: *Heavy metals, *Plant physiology, *Absorption, *Bioaccummulation, *Elodea, Aquatic algae, Acids, Ions, *Lead, *Cadmium, *Copper, *Zinc, *Iron, Water chemistry, Water analysis, Chemical analysis, Path of pollutants.

The relationships of enrichment factors and concentration changes of heavy metals in Elodea nuttallii were studied separately and in the presence of phosphoric acid ions. In the first experiment, we studied the relationship between uptake of heavy metals and the concentration in water when E. nuttallii were cultivated separately in the solutions of one of four metals for 30 days. The results indicated that the uptake of heavy metals in the plant increased with increase of the concentrations in water but the enrichment factor decreased. It was seen that the uptake of Pb was greater than that of Cd and Cu and high values of enrichment factors on Pb were confirmed at comparatively low concentration. In the second experiment E. nuttallii was cultivated in the mixed solutions of heavy metals for 30 days. Values of enrichment factor were relatively low in comparison, but the relative ranking of four elements showed same results. It is suggested that the marked decrease of values in Pb and Cd at 0.1 ppm man show synergistic action of these four elements. In the third experiment, we studied the effects of phosphoric acid on the enrichment of heavy metals. The buds of the plant markedly took up heavy metals in comparison with adult bodies of E. nuttallii and the enrichment was increased further when heavy metals at 1.0 ppm coexisted with phosphoric acid at 2.5 ppm. (Deal-EIS)
W79-08051

CYCLICITY OF CLADOCERAN REPRODUCTION AND ITS RELATIONSHIP TO ENVIRONMENTAL FACTORS (REVIEW),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
A. V. Makrushin.
Hydrobiological Journal, Vol. 14, No. 2, p 1-6, 1978. 52 ref.

Descriptors: *Reproduction, *Crustaceans, *Biorhythms, *Photoperiodism, *Daphnia, Animal behavior, Animal physiology, Genetics, Adaptation, Animal populations, Growth stages, Insects, Cycles.

An analysis of literature data on the relationship between the mode of reproduction of cladocerans and environmental factors led to the conclusion that this mode is controlled by the duration of daylight. Cladoceran species are of the long-day and short-day type. In the course of female ontogenesis sensitivity to environmental factors controlling the mode of reproduction changes. In some species the mode of reproduction of the female depends on the conditions under which the preceding generation existed. The question of non-environmentally dependent changes in the norm of response to external factors is discussed. The norm of response to those stimuli on which conversion to gamogenesis depends is a heritable character. As a result of its wide variability with a population the cladocerans easily adapt to the specific dynamics of the environment in different bodies of water. The patterns controlling cyclicity in cladocerans and of diapause in insects are similar. (Deal-EIS)
W79-08052

SORPTION OF CADMIUM AND ITS EFFECT ON GROWTH AND THE UTILIZATION OF INORGANIC CARBON AND PHOSPHORUS OF TWO FRESHWATER DIATOMS,
Argonne National Lab., IL. Radiological and Environmental Research Div.
H. L. Conway, and S. C. Williams.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 579-586, 1979. 2 fig, 5 tab, 26 ref.

Descriptors: *Cadmium, *Sorption, *Diatoms, *Bioaccumulation, Toxicity, Growth rates, Carbon, Phosphorus, Nutrients, Path of pollutants, Heavy metals, Photosynthesis, Plant physiology, Cytological studies, Chemical analysis, Bioassay, Asterionella, Fragilaria, Freshwater.

Cadmium was rapidly sorbed Asterionella formosa and Fragilaria crotonensis during the first 5-10 min of exposure (0.05 to approx. 9 micrograms cadmium per liter), followed by a hyperbolic increase in the cellular cadmium content as a function of time. Results obtained from experiments conducted in the light and dark, experiments using live and dead populations, and cellular site location studies imply that the sorption of cadmium by A. formosa is partially an active process, but for F. crotonensis it appears to be passive Populations of A. formosa exhibited a corresponding decrease in the growth rate as the ambient cadmium concentration was increased from 2 to 9 micrograms per liter. In contrast, the growth rate of F. crotonensis was unaffected at levels ranging from 0.05 to 9 micrograms Cadmium per liter. The utilization of inorganic carbon by A. formosa was unaffected at 4 micrograms Cadmium per liter, but reduced 45% at 9 micrograms Cadmium per liter. The utilization rates of carbon and phosphorus by F. crotonensis were reduced at the lower cadmium concentrations and enhanced at the highest. (Deal-EIS)
W79-08055

IMPACT OF HYPOXIC CONDITIONS IN THE VICINITY OF LITTLE EGG INLET, NEW JERSEY IN SUMMER 1976,
Ichthyological Associates, Inc., Absecon, NJ.
E. V. Garlo, C. B. Milstein, and A. E. Jahn.
Estuarine and Coastal Marine Science, Vol. 8, p 421-432, 1979. 7 fig, 22 ref.

Descriptors: *Dissolved oxygen, *Oxygen requirements, *Mortality, *Aquatic populations, *Echinoderms, *Polychaetes, New Jersey, Benthic fauna, Biological communities, Toxicity, Crustaceans, Clams, Fish behavior, Animal behavior, Fishkill, Water analysis, Little Egg Inlet.

A major kill of marine animals in the New York Bight from July through September 1976 was caused by hypoxic conditions. Its inshore effects were studied in the vicinity of Little Egg Inlet, New Jersey. The macrobenthic community was most severely affected. Echinoderms suffered the greatest mortalities, followed by crustaceans and bivalves. Seven per cent of the Spisula solidissima population was killed. Polychaetes apparently had very low mortalities. Most motile invertebrates and, to a greater extent, fishes were able to avoid the hypoxia. (Deal-EIS)
W79-08056

BLOOD PROPERTIES OF RAINBOW TROUT IN ACUTE HEPATOTOXITY BY CARBON TETRACHLORIDE,
Hiroshima Univ. (Japan). School of Medicine.
Y. Hiraoka, H. Nakagawa, and S. Murachi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 527-532, 1979. 4 fig, 4 tab, 25 ref.

Descriptors: *Rainbow trout, *Toxicity, *Carbon tetrachloride, *Histology, Bioassay, Aquiculture, Chemical properties, Chemical analysis, Cytological studies, Fish physiology, Animal pathology, Proteins, Lipids, Biochemistry, Electrophoresis, Liver.

The liver injury caused by carbon tetrachloride (CCL4) injection in the dorsal aorta of rainbow trout, was evaluated by the changes in some blood parameters. Whereas significant changes of plasma constituents by CCL4 injection were accompanied by the appearance of necrotic areas in liver, the hematological values of affected specimens were nearly equal to those of normal ones. The electrophoretic examination showed depression of albumin fraction and lipoproteins in the CCL4 injected specimens. A compensational increase of certain globulin components was also noticed. The plasma lipid level was observed to decrease with increasing dose in those specimens. The decrease of lipid was for the most part accounted for by the decrease of triglyceride fraction. No significant change was observed in the plasma cholesterol level. (Deal-EIS)
W79-08057

EFFECTS OF DDT AND PCB'S ON SURVIVAL OF LAKE TROUT EGGS AND FRY IN A HATCHERY AND IN LAKE MICHIGAN, 1973-1976,
Michigan Dept. of Natural Resources, Marquette. Marquette Fisheries Research Station.
T. M. Stauffer.
Transactions of the American Fisheries Society, Vol. 108, p 178-186, 1979. 7 tab, 15 ref.

Descriptors: *DDT, *Polychlorinated biphenyls, *Toxicity, *Lake trout, Pesticide toxicity, Pesticide residues, Chemical wastes, Fish eggs, Fish reproduction, Mortality, Growth stages, Fry, Lake Michigan, Brown trout, Fish physiology.

To assess the role of DDT and PCB's in reproductive failure of lake trout (Salvelinus namaycush) planted in Lake Michigan, the author compared mortality of eggs (1.41-5.24 micrograms/g DDT, 3.16-9.90 micrograms/g PCB's) and fry from planted Lake Michigan lake trout with that of eggs (0.05-0.20 micrograms/g DDT, 0.20-0.28 micrograms/g PCB's) and fry from hatchery lake trout. In normal hatchery incubation from fertilization to 6 weeks after swim-up, mortality of Lake Michigan trout (mean + or - 95% confidence limits) was 80 + or - 16% as compared to 46 + or - 14% for hatchery lake trout in 1973-1974 and 50 + or - 9% versus 47 + or - 9%, respectively, in 1974-1975. The significantly higher mortality of Lake Michigan than of hatchery lake trout in 1973-1974 was thought due to causes other than DDT or PCB's. Mortality of Lake Michigan lake trout during different stages of development usually was not linearly correlated with DDT and PCB content. During development in enclosures in Lake Michigan from fertilization or the eyed stage, mortality of Lake Michigan lake trout usually was not significantly greater than that of hatchery fish at eye-up, at swim-up, and at 3 weeks after swim-up. In hatchery tests, Lake Michigan fry mortality (65 + or - 6%) was significantly less than that of hatchery fry (89 + - 6%) after 11 weeks of starvation and was the same (53 + or - 11%) versus 61 + or - 11%) when fry were stressed by half rations for 10 weeks in the presence of similar-sized brown trout (Salmo trutta). The bulk of the evidence indicated that DDT and PCB's did not have an effect on early survival of Lake Michigan lake trout. (Deal-EIS)
W79-08062

THE EFFECT OF AEROCOCCUS VIRIDANS (VAR.) HOMARI ON THE OXYGEN BINDING CAPACITY OF HEMOCYANIN IN THE AMERICAN LOBSTER (HOMARUS AMERICANUS),
Maine Univ. at Orono.
J. H. Rittenburg, M. L. Gallagher, R. C. Bayer, and D. F. Leavitt
Transactions of the American Fisheries Society, Vol. 108, p 172-177, 1979. 2 fig, 2 tab, 17 ref.

Descriptors: *Lobsters, *Infection, *Pathogenic bacteria, *Gaffkemia, Aquiculture, Commercial shellfish, Animal pathology, Bacteria, Toxicity, Mortality, Proteins, Chemical analysis, Spectrophotometry, Animal physiology, Respiration, Oxygen.

The effect of gaffkemia (Aerococcus viridans) infection on the oxygen binding capacity of the hemocyanin component of the American lobster's hemolymph was examined both in vivo and in vitro. Spectrophotometric and electrophoretic ex-

amination of the hemocyanin indicated that accompanying gaffkemia infection was a 50% reduction in the oxygen binding capacity of the hemocyanin. Serum protein levels were unaffected by the infection. In vitro growth of A. viridans in lobster sera resulted in similar findings. Death from gaffkemia may be a result of hypoxia arising from bacterial impairment of the lobster's respiratory exchange system, rather than a result of nutrient depletion as has previously been reported. (Deal-EIS)
W79-08063

CRASSOSTREA VIRGINICA AS AN INDICATOR OF LEAD POLLUTION,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08064

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING PART III - THE WATER QUALITY OF TROUT CREEK, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
R. K. Skogerboe, C. S. Lavallee, M. M. Miller, and D. L. Dick.
Report No. EPA-600/3-79-008, 1979. 68 p, 20 fig, 8 tab, 13 ref.

Descriptors: *Mine drainage, *Streams, *Coal mine wastes, *Strip mine wastes, *Selenium, *Arsenic, Metals, Water quality, Mine wastes, Strip mines, Spoil banks, Calcium, Sulfate, Iron, Manganese, Zinc, Colorado, Trout Creek, Mine spoil drainage.

Water quality parameters have been measured at several on-stream and off-stream sites along Trout Creek, which is recipient of water from coal strip-mining operations. Levels of the gross parameters (e.g., specific conductivity), the common ions (e.g., calcium and sulfate), and some trace components (e.g., selenium) are highest in mine spoil drainages. The impact of the mine spoil drainage on the stream is reflected in the larger quantities of dissolved solids and common ions found at on-stream sites adjacent to and below the mine. Increases in stream concentrations of Mn and Se due to mine inflow can be inferred from the data. Higher concentrations of As, Fe, Mn, Se, and Zn are found in waters draining mine spoils. In the mine spoils, variations in the concentrations of these elements occur with spoil age; more Mn and Zn occur in older spoils, while higher levels of As, Fe, and Se are found in newer spoils. Chemical equilibrium calculations indicate that alkaline precipitation processes can maintain the low concentrations of Al, Cd, Cu, Fe, Pb, and Zn. The general alkaline characteristics of western streams and aquifers suggests that such precipitation equilibria will limit the soluble heavy metal concentrations. (Deal-EIS)
W79-08068

RAPID APPRAISAL OF THE EFFECTS OF VARIOUS SUBSTANCES ON MICROORGANISMS,
Institut National de Recherche Chimique Appliquee, Vert-le-Petit (France).
P. H. Brouzes, A. DePierrefeu, J. Y. Bernhard, and C. Racle.
Progress in Water Technology, Vol. 10, No. 5-6, p 715-725, 1978. 9 fig, 9 ref.

Descriptors: *Analytical techniques, *Digital computers, Computer programming, Research equipment, Automation, Microorganisms, Cytological studies, Waste treatment, Dissolved oxygen, Biodegradation, Industrial wastes, Pollutant identification, Methodology.

In order to forecast the effects of the many substances discharged to treatment plants and natural environments it is advisable to have speedy methods available. A digital computer was used to process automatically a set of microorganism cultures whose respiration was recorded in the presence of the substances studied. It is possible in this way to evaluate inhibiting effects as well as nutrient value or stimulating effects. The method is reproducible and it enabled (production of proteins), to be treated by conventional methods, to be destroyed or treated by other processes in view of their harmful effects on the microflora of waste treatment plants. (Deal-EIS)
W79-08071

EFFECTS OF PH ON THE BIOLOGY AND DISTRIBUTION OF EPHEMERELLA FUNERALIS (EPHEMEROPTERA),
Cornell Univ., Ithaca, NY. Dept. of Entomology and Limnology.
S. B. Fiance.
Oikos, Vol. 31, p 332-339, 1978. 8 fig, 3 tab, 38 ref.

Descriptors: *Hydrogen ion concentration, *Mayflies, Aquatic insects, Life history studies, Fecundity, Food habits, Growth rates, Distribution patterns, Reproduction, Growth stages, Larval growth stage, Acidic water, Life cycles.

The life history, emergence, sex ratio, fecundity, food habits, microhabitat, distributional pattern, and effects of experimental acidification on the emergence, growth, and recruitment of Ephemerella (Eurylophella) funeralis McI). are reported. E. funeral is the only member of the Ephemerellidae known to have a two-year cycle. Larval sex ratio from all study sites was approximately one male for every eight females. Sex ration of adults was found to be side dependent, with males increasing in representation as stream size decreased. The average number of eggs per female was 1853 plus or minus S.E. 87. Facultative parthenogenesis is indicated by the successful development of 53% of 381 eggs taken from an unmated female subimago. Larvae were found in accumulations of organic matter in slower flowing portions of streams and also in permanent woodland pools. Gut contents of larvae were predominantly composed of detritus and decomposing higher plant matter, especially leaves, and fungal growth of submerged wood. E. funeralis appears to decrease in abundance with decreasing stream pH and decreasing organic matter. The experimental acidification of Norris Brook had no effect on the emergence of adults but caused a decrease in growth and nearly eliminated recruitment of the new cohort. A direct relationship between pH and the abundance of E. funeralis in the Hubbard Brook watershed is indicated by the results. (Deal-EIS)
W79-08072

DYNAMICS OF ZINC-65 SPECIFIC ACTIVITY AND TOTAL ZINC IN BENTHIC FISHES ON THE OUTER CONTINENTAL SHELF OFF CENTRAL OREGON,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 5A.
W79-08075

UPTAKE AND LOSS OF RADIOACTIVE CADMIUM BY THE SEA-SKATER HALOBATES ROBUSTUS (HETEROPTERA: GERRIDAE),
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W79-08076

INDIVIDUAL EFFECTS AND INTERACTIONS OF SALINITY, TEMPERATURE, AND ZINC ON LARVAL DEVELOPMENT OF THE GRASS SHRIMP PALAEMONETES PUGIO. I. SURVIVAL AND DEVELOPMENTAL DURATION THROUGH METAMORPHOSIS,
Texas A and M Univ., College Station. Dept. of Biology.
C. L. McKenney, Jr., and J. M. Neff.
Marine Biology, Vol. 52, p 177-188, 1979. 2 fig, 5 tab, 57 ref.

Descriptors: *Salinity, *Water temperature, *Zinc, *Shrimp, *Growth rates, *Palaemonetes, Toxicity, Larval growth stage, Heavy metals, Resistance, Life cycles, Animal physiology, Estuaries, Aquatic populations.

Larvae of the estuarine grass shrimp were reared from hatch through successful completion of metamorphosis in 80 combinations of salinity (3 to 31%), temperature (20 degrees to 35 degrees C), and zinc (0.00 to 1.00 ppm). Outside the optimal salinity-temperature conditions of 17 to 27% S and 20 to 27 degrees C, viability of larvae was reduced by both the individual effects of salinity and temperature and interactions between the two factors. Survival capacity of larvae and resistance adaptations to salinity and temperature were progressively reduced by zinc concentrations from 0.25 to 1.00 ppm Zn. Response-surface analysis of the data suggested that the duration of total larval development of P. pugio was least at salinities from 18 to 23% and at temperatures from 30 degrees to 32 degrees C. At both higher and lower salinity-temperature conditions and in increasing zinc concentrations from 0.25 to 1.00 ppm Zn, developmental rates were retarded. A significant zinc-temperature interaction existed, whereby increasing zinc concentrations reduced both survival and developmental rates of larvae more at suboptimal temperatures. Larval resistance to zinc toxicity was least at supraoptimal salinities, indicative of a significant zinc-salinity interaction. The reduced viability, restricted euryplasticity, and retarded developmental rates of P. pugio larvae developing in media with low-level zinc contamination would limit the distributive properties of the pelagic phase in the life cycle of the species and reduce recruitment both into and out of the parent estuarine population. (Deal-EIS)
W79-08077

EFFECTS OF SUSPENDED SEDIMENTS ON PHOTOLYSIS RATES OF DISSOLVED POLLUTANTS,
Environmental Research Lab., Athens, GA.
G. C. Miller, and R. G. Zepp.
Water Research, Vol. 13, p 453-459, 1979. 3 fig, 4 tab, 13 ref.

Descriptors: *Ultraviolet radiation, *Suspended solids, *Euphotic zone, *Photolysis, Solar radiation, Chemical reactions, Absorption, Turbidity, Wavelengths, Degradation(Decomposition), Energy transfer.

Data are presented concerning the effects of suspended sediments upon photolysis rates of dissolved ultraviolet (u.v.) absorbing pollutants. The malachite green leucocyanide actinometer was found to be a convenient and sensitive device for measurement of solar u.v. radiation (approx. 330 nm) in sediment suspensions. Irradiance measurements by the actinometer were employed to compute diffuse attenuation coefficients for sediment suspensions from six natural water bodies in Georgia, Mississippi, and Montana. Specific attenuation coefficients were remarkably similar for all the sediments examined. Evidence is presented that large underestimates of photolysis rates result when beam attenuation coefficients of turbid water bodies are employed to compute the effects of light attenuation. Finally, it is demonstrated that photolysis rates within the photic zone are generally more rapid in turbid than in clear water. Enhanced photolysis rates in turbid waters are attributed to the increased diffuseness of light caused by scattering. (Deal-EIS)
W79-08080

POLONIUM-210 AND LEAD-210 IN MARINE FOOD CHAINS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W79-08082

TRANSFER OF MERCURY FROM FISH CARCASS TO FORMICA AQUILONIA (HYMENOPTERA, FORMICIDAE),
Helsinki Univ. (Finland). Dept. of Environmental Conservation.
For primary bibliographic entry see Field 5A.
W79-08084

SOURCES OF POLLUTION FROM AGRICULTURAL DRAINAGE,
California Regional Water Quality Control Board,

Sacramento. Central Valley Region.
R. E. Merrill, R. M. Van De Pol, and W. E. Ryley.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings Paper 14605, p 137-145, June 1979. 2 fig, 3 tab, 3 ref, 1 append.

Descriptors: *Water pollution sources, *Water quality, *Agriculture, *California, Irrigation, Drainage, Management, Salinity, Suspended solids, Pollutants, Path of pollutants, Monitoring, Permits, Water pollution, Regulation, Rivers, Flow, Streamflow, Legislation, Federal laws.

In response to Public Law 92-500, a National Pollutant Discharge Elimination System (NPDES) permit program for irrigated agriculture was developed by California in 1974. Approximately 3,000,000 acres (1,200,000 ha) are now under permit. The NPDES permit contains a self-monitoring program that is carried out by water purveying and drainage organizations. Monitoring during the first 2 yr was limited to measurements of flow, salinity, and suspended solids for supply and discharge waters. The information provided by the monitoring program has provided baseline data for surface waters utilized by irrigated agriculture. Since some agricultural discharges have been shown to exceed water quality 'objectives' of surface waters in California, best management practices are being developed in pollution control. Sediment problems are being dealt with by 208 planning sediment control programs, while salinity discharge problems are being considered by the Inter-Agency Drainage Program and may also be handled in some areas by 208 planning. (Sims-ISWS)
W79-08094

ENVIRONMENTAL CHEMISTRY OF COPPER IN LAKE MONONA, WISCONSIN,
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
I. Sanchez, and G. F. Lee.
Water Research, Vol. 12, No. 10, p 899-903, 1978, 6 fig, 1 tab, 10 ref.

Descriptors: *Environmental effects, *Copper, *Water pollution, Water quality, Water chemistry, Aquatic life, Weed control.

The purpose of this study was to investigate the environmental fate of copper added to Lake Monona for algae control. The lake is thermally stratified in midsummer. Copper concentrations in the epilimnion were about 4 microg/1 and in the hypolimnion about 0.3 microg/1. It was concluded that addition of large amounts of copper has not resulted in build-up in the water column primarily due to the precipitation of copper as a basic carbonate under oxic conditions. Under anoxic conditions, soluble copper appears to be limited by sulfide. The sediments have acted as a sink for the added copper. It was concluded that the copper content of the water column is smaller than any concentration known to have significant adverse effects on aquatic life. (Chilton-ORNL)
W79-08129

SOME PROBLEMS OF THE METHOD OF MEASUREMENT OF HYDROCHEMICAL ELEMENTS BY AUTOMATIC STATIONS,
L. B. Kim, S. F. Yudin, and L. L. Solodov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 224-226, 1977. 5 fig, 2 ref. Translated from Ekspress-Informatsiya, Gidrologiya Sushi, No. 2 (49), p 1-7, 1977.

Descriptors: *Water chemistry, *Measurement, *Automation, *Correlation analysis, Sampling, Water temperature, Hydrogen ion concentration, Dissolved oxygen, Turbidity, Reservoirs, Water quality, Statistics, Data processing.

The planning and development of a surface water quality control system raise some questions regarding the method of measurement and analysis of physicochemical parameters in bodies of water. Along with the problem of determining the optimum times of measurements and their necessary and sufficient accuracy, there are other problems associated with determination of the permissible loss of information on one or several elements and its recovery. The optimum times and accuracy of measurements can be determined from a spectral analysis of measurements of hydrochemical elements made at much smaller intervals than those prescribed by the standard program of operation of the planned system. In that way, one can obtain the distribution of the dispersion of the hydrochemical process from the frequency bands of the spectrum and determine the frequency starting from which the fluctuations of the process can be perceived as noise. (Sims-ISWS)
W79-08146

GREAT LAKES WATER QUALITY, SIXTH ANNUAL REPORT, APPENDIX D: RADIOACTIVITY SUBCOMMITTEE REPORT,
Report to the Implementation Committee, Great Lakes Water Quality Board, July 1978. 78 p, 6 fig, 28 tab, 25 ref, 2 append.

Descriptors: *Water quality, *Great Lakes, *Radioactivity, *Radioactivity effects, Tritium, Strontium, Cesium, Fallout, Water pollution sources, Uranium, Mining wastes, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario, International Commission on Radiological Protection.

Detailed information and data available as of May 1978 concerning radioactivity in the Great Lakes Basin are presented. During 1977 the levels of radionuclides in Lakes Michigan, Huron, Erie, and Ontario were monitored in the open lakes, in nearshore waters, and at municipal water intakes. Most of the radioactivity detected comes from nuclear weapons testing fallout, except for 226Ra which occurs naturally and is occasionally heightened by uranium mining and refining operations. The concentrations measured in 1977 were low and similar to those found in 1976. Occasional transient increases in 3H and 137Cs levels were detected near the discharges of two nuclear power stations. The levels of 137Cs in Lake Ontario fish correlate with the water levels. Concentration of 226Ra at the mouth of the Serpent River, which drains the Elliot Lake uranium mining area decreased slightly over the past year, but the river remains a problem area, because the 226Ra level exceeds Ontario's criterion of 3 pCi/1. Strontium 90 (90Sr) is the major contributor to radiological dose committment in Great Lakes water. The calculated dose from 90Sr decreased markedly for 1977 due to a major change in the International Commission on Radiological Protection's recommendations for the calculation of dose. The 1976 value averaged 0.4 mrem for all the lakes, and the average for 1977 is 0.07 mrem. (Davison-IPA)
W79-08169

GREAT LAKES WATER QUALITY SIXTH ANNUAL REPORT. APPENDIX C. ANNUAL REPORT OF THE REMEDIAL PROGRAMS SUBCOMMITTEE.
Report to the Implementation Committee, Great Lakes Water Quality Board, July 1978. 251 p, 4 fig, 30 tab, 2 append.

Descriptors: Great Lakes region, *Great Lakes, Water quality standards, Phosphorus, Water pollution sources, *Sewage, Lake Erie, Industrial wastes, *Pulp and paper industry, *Oil industry, *Mineral industry.

The status of US and Canadian efforts to meet Great Lakes water quality standards are reviewed. Changes in federal legislation and regulatory actions are described. Eight hundred and twenty-five point sources are reported of which 50% of the US and 62% of the Canadian met 1977 loading requirements. One hundred and sixty-five dischargers contributed to water quality violations. In the US, 63% of the 1971 sewered population was provided with adequate treatment, while 99% of the same Canadian population was provided with adequate treatment. Canadian municipal phosphorus loadings have decreased, and Detroit continues to be the greatest contributor by discharging nearly 60% of the Lake Erie phosphorus load. Disposal of municipal sewage causes problems including air pollution, odor, costs, energy requirements, sludge toxicity, and lack of land available for land disposal. Pollution control programs in three industrial categories are reviewed: pulp and paper, iron and steel, and petroleum refineries. All have produced pollution reductions. (Small-FIRL)
W79-08170

THE MISSOURI BASIN REGION'S WATER QUALITY PLANNING STRATEGY PLANNING DOSSIER. SECOND EDITION.
Federal Water Quality Control Administration, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 273, Price codes: A06 in paper copy, A01 in microfiche. Report June 1970. 98 p, 1 append.

Descriptors: *Water quality, *Water resources development, *River basin development, *Missouri River Basin, *Water pollution, *Water pollution sources, *Water resources planning, Water supply development, Water supply, Recreation demand, Regional development, Planning, Comprehensive planning, Resources, Water use, Consumptive use.

This report delineates a strategy for water planning for the Missouri River Basin of Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota and Wyoming. The objectives include identification of significant water problems, establishment of a priority ranking system for water projects, determination of priority based on such a ranking system, assignment of responsibilities for planning to the proper level of government (i.e., Federal, state or local), provision of guidance in focusing upon special water resource problems, creation of a basin information system, outlining the Region's short- and long-range project work schedule, and outlining the general approach to be taken in all basin planning activities. As of 1965, irrigation and steam-electric power accounted for 90% of water use in the basin, while irrigation and livestock accounted for 96% of water consumption. Serious causes of water pollution within the Missouri Basin Region include animal waste pollution, siltation, salinity from agriculture, and general agricultural runoff. Sub-basins within the Missouri system were ranked in order of need for management by an Environmental Multiplier Index (EMI) from a high of 5 (streams with a low level of pollution and high level of use) to a low of 1 (low level of both pollution and use). Recurring problems identified in many individual basins included pollution of streams from recreation growth, industrial waste discharge, sedimentation and erosion, and irrigation return flows. Forty-four projects were ranked in order of planning priority. The report recommends full integration of its proposed strategy with local government planning programs within the basin. (Arnold-NC)
W79-08174

OIL DETECTOR,
D. M. B. Brown.
U.S. Patent No. 4,137,495, 4 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1859, January 30, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution sources, Water pollution control, Oily water, Pollutant identification, Equipment, Electrodes, Oil detection.

An oil detector comprises a pair of liquid electrodes having a capillary channel between them of such a size that water and oil will be held there by surface tension, and means for electrically connecting the electrodes to a measuring circuit. In use, the detector is connected to a measuring circuit capable of responding to changes in the electrical resistance between the electrodes. When the detector is then placed, immersed in but adjacent the surface of, water free from oil, the channel becomes filled with water and current can flow between the electrodes. The change in the resistance between the electrodes is detected by a measuring circuit and used to activate a warning system. (Sinha-OEIS)
W79-08230

ENRICHMENTS OF ZINC, LEAD, AND COPPER IN RECENT SEDIMENTS OF WINDERMERE, ENGLAND,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
J. Hamilton-Taylor.
Environmental Science and Technology, Vol. 13, No. 6, p 693-697, June 1979. 1 fig, 2 tab, 34 ref.

Descriptors: *Metals, *Heavy metals, *Sediments, *Lake sediments, Pollutants, Pollutant identification, Sampling, Cores, Chemical analysis, Zinc, Lead, Copper, Aluminum, Sulfur, Iron, Manganese, Water pollution, Water pollution sources, Path of pollutants, *Windermere(England).

The concentrations of Zn, Pb, Cu, Al, S, Fe, and Mn were determined in sediment cores from Windermere, N. W. England. Zn, Pb, and Cu are greatly enriched in sediments deposited during the last 130 years. Maximum concentrations were 1180 ppm of Zn, 589 ppm of Pb, and 140 ppm of Cu compared to baseline concentrations of 160, 56, and 24 ppm, respectively. Known sedimentation rates have been used together with the measured concentrations to calculate fluxes of the 3 metals into the lake sediments. Present-day anthropogenic fluxes (total - baseline) were estimated to be 16.9, 9.9, and 1.8 microgram/sq cm/yr for Zn, Pb, and Cu, respectively. Metal sources and transport mechanisms within the lake were discussed, where possible quantitatively. It appears that atmospheric supply of the metals and uptake by diatoms may be important factors in controlling sediment concentrations. (Sims-ISWS)
W79-08257

STUDIES ON THE SEDIMENT OF ST. MARGARET'S BAY, NOVA SCOTIA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2L.
W79-08267

COMBINED SEWER OVERFLOW QUALITY FROM TREATMENT PLANT DATA,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
J. A. Mueller, and A. R. Anderson.
Journal of the Water Pollution Control Federation, Vol. 51, No. 5, p 958-973, May 1979. 13 fig, 8 tab, 14 ref. NOAA 04-6-002-44027.

Descriptors: *Combined sewers, *Overflow, *Treatment facilities, *Model studies, *New York, Mathematical models, Pollutants, Runoff, Precipitation(Atmospheric), Rainfall, Sewers, Storm runoff, Suspended solids, Biochemical oxygen demand, Data processing, Analytical techniques, Water pollution, Water pollution sources, Path of pollutants.

An indirect method of estimating urban stormwater runoff and overflow loads and concentrations from combined sewer systems was presented. A mathematical framework consisting of mass and flow balances for the sewer system and its attendant treatment plant was used with treatment plant sampling data and rainfall data as input. The mass balance was applied to the drainage area of the 26th Ward Water Pollution Control Plant, Brooklyn, New York. Data on suspended solids, volatile suspended solids, and total and soluble biochemical oxygen demand for 7 selected years were analyzed in depth. Mean annual values of load and concentration were compared with others' directly sampled runoff and overflow data. Sensitivity of model results to variations in input parameters was checked. (Sims-ISWS)
W79-08270

DETERMINATION OF HEAVY METALS AND SELENIUM IN FISH FROM UPPER AUSTRIAN WATERS -- PART 2: LEAD, CADMIUM, SCANDIUM, CHROMIUM, COBALT, IRON, ZINC AND SELENIUM (IN GERMAN),
Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie.
For primary bibliographic entry see Field 5A.
W79-08276

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH - IV EFFECTS ON ULTRASTRUCTURES OF HEPATIC AND RENAL CELLS OF THE CARP AND THE PORGY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W79-08277

THE DOMINANCE OF NANOPLANKTON AS AN INDICATOR OF MARINE POLLUTION: A CRITIQUE,
California Univ., San Diego. La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5A.
W79-08288

EFFECTS OF THE SPAWNING MIGRATION OF THE ALEWIFE, ALOSA PSEUDOHARENGUS, ON FRESHWATER ECOSYSTEMS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
A. G. Durbin, S. W. Nixon, and C. A. Oviatt.
Ecology, Vol. 60, No. 1, p 8-17, 1979. 4 fig, 9 tab, 42 ref.

Descriptors: *Nutrients, *Ecosystems, *Fish migrations, *Spawning, *Alewife, *Alosa, Phytoplankton, Eutrophication, Phosphorus, Nitrogen, Respiration, Lakes, Rhode Island, Productivity.

The influx of large numbers of alewife into relatively small freshwater systems may have a considerable impact upon pre-established food chains and nutrient cycles. In tank experiments using pond microcosms, the initial response to the addition of the fish was a large phytoplankton bloom and an increase in litter respiration. The phytoplankton bloom was short-lived, and the most lasting supply of insect and benthic invertebrate food for young fish. The respiration rate of autumn leaves incubated in alewife streams during the migration was significantly higher than that of leaves incubated simultaneously in a stream which had no alewife run. Respiration rates of leaves incubated in the same streams before the arrival of alewives did not differ significantly. The increase in litter respiration, and an indication of microbial and invertebrate activity on the leaf surface, was attributed to the additional nutrients supplied by the fish. (Deal-EIS)
W79-08289

MERCURY POLLUTION OF THE MARINE ENVIRONMENT IN THE REGION OF MARSEILLE, MEDITERRANEAN, FRANCE. PART 3-DEGREE OF CONTAMINATION BY MERCURY OF THE ECHINODERMS LIVING IN THE KELP BEDS IN THE VICINITY OF THE LARGE SEWER OF THE CITY OF MARSEILLES, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Sciences de la Mer et de l'Environment.
For primary bibliographic entry see Field 5A.
W79-08290

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
For primary bibliographic entry see Field 5A.
W79-08296

CONCENTRATION OF SILVER 110M IN A MARINE FOOD CHAIN. II. UPTAKE THROUGH THE FOOD CHAIN,
Nantes Univ. (France). Lab. de Biologie Marine.
J-C. Amiard.
Cahiers de Biologie Marine, Vol. 22, p 189-199, 1979. 3 fig, 4 tab, 17 ref.

Descriptors: *Food chains, *Absorption, *Trophic level, *Silver, *Bioaccumulation, Primary productivity, Secondary productivity, Crabs, Diatoms, Water chemistry, Metals, Path of pollutants.

The transfer of silver 110m through a natural marine food chain was studied experimentally. Silver 110m concentration decreased as the level in the productivity pyramid was higher and transfer factors between two successive trophic levels (f.t.) were low: 0.004 between Diatomae and Scrobicularlae, 0.128 between Scrobicularlae and Crabs. However transfer factors between water and the trophic level considered (F.T.) were always above 1: 8.1 for Scrobicularlae, 1.04 for Crabs. The mean percentage assimilated after each meal was 50 per cent and 65 per cent for Scrobicularlae and Crabs respectively. Fecal excretion prevailed (26-28 per cent). There did not seem to be any regulation of silver 110m by the various species studied. Scrobicularlae and Crabs retained 5 per cent and 12 per cent respectively of silver 110m supplied by all the meals. (Deal-EIS)
W79-08306

ALTERATION IN ENZYME ACTIVITIES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS EXPOSED TO ENDRIN,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
S. K. Sharma, and K. V. Sastry.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 17-20, 1970. 1 tab, 15 ref.

Descriptors: *Enzymes, *Endrin, *Pesticide toxicity, *Tissue analysis, *Channa, Pesticide residues, Chlorinated hydrocarbon pesticides, Toxicity, Inhibition, Biochemistry, Fish physiology, Animal metabolism, Chemical analysis, Bioassay.

The fish were treated with a sub-lethal concentration (0.01 mg/L) of endrin for 30 days in tap water. After the exposure period the liver and kidney were assayed for the following enzymes: alkaline phosphatase; acid phosphatase; glucose-6-phosphatase; x-smylase and lipase. The activities of all three phosphatases and the lipase in the liver was inhibited by treatment of fishes by endrin. In contrast to liver, the three phosphatases showed a slight elevation in activity in the kidney. However, the stimulation of alkaline and acid phosphatases was statistically insignificant. (Deal-EIS)
W79-08312

UPTAKE AND DEPURATION OF PETROLEUM HYDROCARBONS IN THE MANILA CLAM, TAPES SEMIDECUSSATA REEVE,
California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5A.
W79-08314

ENDRIN TOXICOSIS ON FEW ENZYMES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS (BLOCH),
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and S. K. Sharma.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 4-8, 1979. 1 tab, 20 ref.

Descriptors: *Endrin, *Pesticide toxicity, *Enzymes, *Channa, *Tissue analysis, Chemical analysis, Fish physiology, Animal metabolism, Inhibition, Biochemistry, Chlorinated hydrocarbon pesticides, Path of pollutants, Teleosts, Phosphatase.

Exposure of fishes for 15 days to endrin in vivo resulted in the inhibition of activities of acid phosphatase and glucose-6-phosphatase in the liver. This is followed by an elevation above normal level in fishes treated for 30 days. In contrast to liver, kidney revealed an increased activity of all the three enzymes at both the experimental periods. At 15 days of exposure, there is no significant change in acid phosphatase activity but kidney showed an elevation in activity. (Deal-EIS)
W79-08315

FURTHER STUDIES ON THE TOXICITY OF DDT TO PLANARIA,
National Council for Scientific Research, Beirut (Lebanon). Marine Research Center.
H. H. Kouyoumjian, and J. P. Villeneuve.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 109-112, 1979. 1 fig, 1 tab, 4

ref.

Descriptors: *DDT, *Pesticide toxicity, *Planaria, *Tissue analysis, *Bioaccumulation, Reproduction, Absorption, Animal metabolism, DDD, DDE, Chlorinated hydrocarbon pesticides, Path of pollutants, Chemical analysis, Inhibition, Growth rates, Benthos, Animal pathology, Flat worms.

The paper studies the possible deleterious effects of DDT on regeneration and asexual fission, and looks briefly into the rate of absorption and metabolism of DDT by normal and regenerating (decapitated) planaria. Concentrations of 0.15 ppm DDT had an inhibitory effect on asexual fission during a 14-day trial. Regenerating planaria were able to resist DDT absorption during the first 24-h of exposure. After this period, planaria absorb DDT at an increased rate. DDT absorption by regenerating planaria appears to slow down the rate of regeneration. Both normal and regenerating planaria could metabolize DDT and DDE. DDE was found to be the major metabolite. (Deal-EIS)
W79-08316

A COMPARATIVE STUDY OF THE EFFECT OF ACUTE AND CHRONIC MERCURIC CHLORIDE TREATMENT ON THE ACTIVITIES OF A FEW DIGESTIVE ENZYMES OF A TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08319

ALKANES IN FISH FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
For primary bibliographic entry see Field 5A.
W79-08320

UPTAKE, TISSUE DISTRIBUTION, METABOLISM AND ELIMINATION N-OCTANO-1-14C-HYDROXAMIC ACID BY BROOK TROUT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08321

UPTAKE AND METABOLISM OF SELENIUM BY OYSTERS,
Southhampton Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W79-08322

MERCURIC CHLORIDE INDUCED ENZYMOLOGICAL CHANGES IN KIDNEY AND OVARY OF A TELEOST FISH, CHANNA PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and M. K. Agrawal.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 38-43, 1979. 1 tab, 25 ref.

Descriptors: *Mercury, *Enzyme, *Channa, *Tissue analysis, Teleosts, Heavy metals, Fish physiology, Animal metabolism, Inhibition, Chemical analysis, Biochemistry, Lipids, Amino acids, Proteins.

The effect of 1.8 mg/L and a sublethal concentral (0.30 mg/L) of in vivo mercuric chloride exposure on the activities of acid and alkaline phosphatases, glucose-6-phosphatase, lipase and urease in the kidneys and ovaries of a teleost fish, Channa punctatus has been studied after 96 hr and 30 days, respectively. It has been observed that the activities of all the enzymes excepts acidphosphatase were significantly inhibited in both the tissues. However, treatment for 96 hr resulted in more marked inhibition than 30 days of treatment. Acid phosphatase showed elevation in activity in the kidney after 96 hr of treatment. (Deal-EIS)
W79-08323

ACCUMULATION OF POLYCHLORINATED BIPHENYL (PHENOCLOR DP6) BY ESTUARINE FISH,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W79-08325

CARP (C1-2) OVERWINTERING AND BREEDING IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
For primary bibliographic entry see Field 5C.
W79-08332

EVALUATION OF ITT RAYONIER, INC., OUTFALL PORT ANGELES HARBOR, WASHINGTON,
National Field Investigations Center, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 600, Price codes: A06 in paper copy, A01 in microfiche. December 1974. 105 p, 34 fig, 12 tab, 4 ref, 2 append.

Descriptors: *Water quality, Waste water, *Pulp and paper industry, *Effluents, Diffusion, Ocean currents, Outfall sewers, Remote sensing, Liquid wastes, Juan de Fuca Strait, Port Angeles Harbor(Washington).

A remote sensing study using optical and thermal sensors was conducted to document the dilution or dispersion characteristics of the ITT Rayonier, Inc. pulp and paper mill submerged outfall diffuser effluent. This outfall discharges an ammonia-base hot caustic extract and bleach plant effluent and 20% of the plant's total ammonia-base spent sulfite liquor wasteload. A total of 18,000 to 22,700 kg/day of biochemical oxygen demand (BOD) is discharged by the submerged outfall. The study included five remote sensing flights over Port Angeles Harbor, Washington, for which drogue assemblies were deployed to monitor the current and displacement of water at three pre-selected depths and at the surface. Results of two flights showed that the drogues released near the diffuser moved into the harbor instead of dispersing directly into the Strait of Juan de Fuca according to the diffuser design and location. The plume in the zone of dilution was cooler than the surface temperature of the receiving water, and did not exceed the thermal limitations. From an analysis of the physical and chemical data, and the dispersion and circulation characteristics in the area of the submerged outfall, it is concluded that the predicted performance of this outfall as described in the ITT Rayonier study is incorrect. (Davison-IPA)
W79-08349

REPORT ON FY-78 NUMERICAL MODELING IN THE STRAIT OF JUAN DE FUCA AND PUGET SOUND,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
NOAA Technical Memorandum ERL MESA-38, February 1979. 35 p, 20 fig, 10 ref.

Descriptors: *Meteorology, *Models, *Oil spills, Tidal effects, Climatology, Oceanography, Washington, Puget Sound, Strait of Juan de Fuca, Tidal currents, Oil spill trajectories.

This report summarizes and interprets tidal current and oil spill trajectory predictions obtained from a computer model of the Strait of Juan de Fuca and regional wind fields derived from a computer model of the entire Puget Basin. The meteorology of the Puget Sound Basin is discussed with respect to three dominant weather patterns which were subsequently used to run the regional meteorological model. These model results are incorporated into oil spill trajectory calculations as large scale wind fields over the Straits which are sequentially keyed by baric types for any given modeling period. A sea breeze condition was also considered and is described in the trajectory modeling section. The oceanography of the Strait of Juan de Fuca region is presented as a discussion of the dominant features, tidal and estuarine flow components, and some possible deviations from these main elements. The tide subroutines constructed for the trajectory model are based on empirical data from NOS tidal current stations and are inline functions to the trajectory model. The principal product of the model was a series of simulated oil spill trajectories. (NOAA)
W79-08379

PUGET SOUND CIRCULATION: FINAL REPORT FOR FY77-78,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2L.
W79-08380

LEACHATE MIGRATION FROM A PESTICIDE WASTE DISPOSAL SITE IN HARDEMAN COUNTY, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. L. Sprinkle.
Geological Survey Water-Resources Investigations 78-128 (open-file report), 1978. 35 p, 10 fig, 5 tab, 8 ref.

Descriptors: *Underground waste disposal, *Chlorinated hydrocarbon pesticides, *Leachate, *Infiltration rates, *Path of pollutants, Groundwater, Water table aquifers, Water pollution sources, Water analysis, Dieldrin, Endrin, Heptachlor, *Hardeman County(Tenn).

Between 1964 and 1972, approximately 300,000 drums (55-gallon steel barrels) of waste derived from the manufacturing of pesticides were buried on 45 acres of land in northern Hardemen County, Tennessee. Leachates from these wastes are migrating from the disposal site in surface runoff, through shallow perched water zones, and through the local water-table aquifer. Compounds identified in the leachates included: dieldrin, endrin, chlordene, heptachlor, heptachlor epoxide, pentachlorocyclopentadiene, and hexachloro-bicycloheptadiene. The rate of migration of some of the leachate compounds in the water-table aquifer was found to be at least 80 feet per year. (Woodard-USGS)
W79-08392

PROGRESS REPORT ON THE BLACK MESA, ARIZONA, GROUND-WATER MONITORING PROGRAM,
Geological Survey, Flafstaff, AZ. Water Resources Div.
For primary bibliographic entry see Field 4C.
W79-08400

A CONFERENCE OF THE MINERAL ESTATE INCLUDES A TRANSFER OF GEOTHERMAL RESOURCES,
For primary bibliographic entry see Field 6E.
W79-08415

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08428

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX L--WATER POLLUTION CONTROL,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force
For primary bibliographic entry see Field 5A.
W79-08445

CONTROL OF FOULING ORGANISMS IN ESTUARINE COOLING WATER SYSTEMS BY CHLORINE AND BROMINE CHLORIDE,

Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
For primary bibliographic entry see Field 5C.
W79-08449

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
For primary bibliographic entry see Field 5C.
W79-08465

MICROBIOLOGICAL CYCLING OF OIL IN ESTUARINE MARSHLANDS,
Georgia State Univ., Atlanta.
For primary bibliographic entry see Field 5C.
W79-08474

5C. Effects Of Pollution

THE EFFECTS OF SALINE IRRIGATION WATER AND GYPSUM ON PERENNIAL PASTURE GROWN ON A SODIC, CLAY SOIL AT KERANG, VICTORIA,
Victoria Dept. of Agriculture, Kerang.
J. H. Mount, and D. L. Schuppan.
Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. 18, No. 93, p 533-538, August 1978, 5 tab, 3 fig, 8 ref.

Descriptors: *Effluents, *Alkaline soils, *Irrigation effects, *Saline water, *Gypsum, Soil-water-plant relationship, Crop response, Australia, Pasture management, Irrigation operation and maintenance, Clays, Irrigation water, Soil properties, Environmental effects.

This study examines the effects of using a range of saline effluents to irrigate clay sodic soils on pasture production in northern Victoria, Australia. During five consecutive growing seasons, 1971-1975, saline effluents of 6000, 4000, 2400, 1600, 800, and 100 mg l-1 total soluble salt (TSS) were used to irrigate perennial pasture grown on heavy clay sodic soils. Results indicate that (1) after five seasons, there were no significant differences in pasture dry matter yields between the 100 and 800 or 1600 mg l TSS treatments, (2) in the fifth season, there were significant five percent higher dry matter yields in the 800 mg l TSS treatment compared to the 1600 mg l treatment, and (3) when effluents were above 1600 mg l TSS treatments, dry matter yields were inversely related to salinity levels. Gypsum applications, included among the various treatments, produced no significant dry matter response in the 4th and 5th seasons, although significant responses at the 10 and 20 t ha-1 application rates were indicated in the 2d and 3d seasons respectively. Lucerne (Medicago sativa), perennial ryegrass (Lolium perenne), and tall wheatgrass (Agropyron elongatum) proved to be valuable pasture species when irrigated with saline water. (Tickes-Arizona)
W79-08020

EFFECTS OF THE TRIAZINE HERBICIDE CYANATRYN ON AQUATIC ANIMALS,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
H. R. A. Scorgie, and A. S. Cooke.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 135-142, 1979. 2 fig, 2 tab, 12 ref.

Descriptors: *Herbicides, *Pesticide toxicity, *Triazine pesticides, *Cyanatryn, *Tadpoles, Organic pesticides, Snails, Daphnia, Frogs, Growth stages, Mortality, Juvenile growth stage, Animal behavior, Animal physiology, Bioassay.

This series of experiments showed that D. pulex and tadpoles of the frog, R. temporaria, are affected by short-term exposure to levels of cyanatryn as low as those recommended for use in the field (0.05 and 0.2 ppm). Lymnaea peregra juveniles showed no adverse effects at these levels, but egg production appeared to be affected. Tadpoles were the most sensitive of the animals tested. When, however, groups of tadpoles were caged in drainage channels and exposed to 0.02 ppm cyanatryn, one tenth of the recommended concentration, there were no detectable effects. (Deal-EIS)
W79-08034

MERCURY CONCENTRATIONS IN THREE SPECIES OF TUNAS COLLECTED FROM VARIOUS OCEANIC WATERS,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
For primary bibliographic entry see Field 5A.
W79-08035

RELIABILITY OF AQUATIC INSECTS VERSUS WATER SAMPLES AS MEASURES OF AQUATIC LEAD POLLUTION,
Colorado Div. of Wildlife, Montrose.
For primary bibliographic entry see Field 5A.
W79-08036

FATE AND EFFECTS OF CADMIUM IN AN EXPERIMENTAL MARINE ECOSYSTEM,
Biologische Anstalt Helgoland, Hamburg (Germany, F. R.).
For primary bibliographic entry see Field 5A.
W79-08037

DETERMINATION OF THE ABSORPTION OF CR+6 AND CR+3 IN AN ALGAL CULTURE OF CHLORELLA PYRENOIDOSA USING 51CR,
Roskilde Univ. Center (Denmark). Inst. for Environment, Technology and Society.
For primary bibliographic entry see Field 5A.
W79-08038

INVESTIGATION ON THE DISTRIBUTION OF DDT AND AROCLOR 1254 IN LABORATORY-GROWN MARINE PHYTOPLANKTON,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
For primary bibliographic entry see Field 5A.
W79-08039

MOBILIZATION AND ACCUMULATION OF SEDIMENT BOUND HEAVY METALS BY ALGAE,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08040

SURVIVAL AND DEVELOPMENT OF ATLANTIC SALMON EGGS AND FRY AT THREE DIFFERENT TEMPERATURES,
Norges Landbrukshoegskole, Vollebekk. Dept. of Animal Genetics and Breeding.
K. Gunnes.
Aquaculture, Vol. 16, p 211-218, 1979. 7 fig, 3 tab, 12 ref.

Descriptors: *Water temperature, *Atlantic Salmon, *Toxicity, Freshwater fish, Fish eggs, Fry, Mortality, Growth rates, Growth stages, Fish reproduction, Embryonic growth stage, Salmonids, Fish physiology, Aquiculture.

Groups of Atlantic salmon (Salmo salar) eggs were incubated at 12, 10 and 8 degrees C. At 12 degrees C mortality was high and fry averaged little more than half the weight of those hatched at 10 or 8 degrees C. Development of alevins to the 'swim-up' stage was also abnormal at 12 degrees C. The results suggest that 10 degrees C is optimal for incubating Atlantic salmon eggs. For the period between hatching and swim-up, the most favourable temperature varies according to the temperature used during incubation. Mortality rate during the first 6 weeks of feeding was correlated with mortality during earlier development. Total numbers of day-degrees required by the eggs and fry to reach the eyed, hatching, and swim-up stages of developmet were significantly less at 12 degrees C than at 10 or 8 degrees C. However, total day-degrees required to reach an average weight of 0.5 - 0.6 g were almost the same regardless of temperature during hatching. (Deal-EIS)
W79-08041

EFFECTS OF HEAVY METALS ON BENTHIC MACROINVERTEBRATE DENSITIES IN FOUNDRY COVE ON THE HUDSON RIVER,
New York Univ. Medical Center, NY. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 5A.
W79-08042

ACUTE TOXICITY OF COPPER, CHROMATE, ZINC, AND CYANIDE TO FRESHWATER FISH: EFFECT OF DIFFERENT TEMPERATURES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-08043

THE EFFECT OF THE LIMING OF FISH-BREEDING PONDS ON SOME CRUSTACEAN PLANKTERS,
Ukrainian Research Inst. of the Fish Industry, Kiev (USSR).
For primary bibliographic entry see Field 5A.
W79-08044

TOXIC SUBSTANCES IN THE EFFLUENTS OF PETROCHEMICAL PLANTS AND THEIR EFFECT ON AQUATIC ORGANISMS (REVIEW),
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5B.
W79-08045

ALTERATIONS IN CALCIUM ACCUMULATION BEHAVIOR IN RESPONSE TO CALCIUM AVAILABILITY AND POLYCHLORINATED BIPHENYL ADMINISTRATION,
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-08046

BROWN PELICAN: POPULATION STATUS, REPRODUCTIVE SUCCESS AND ORGANOCHLORINE RESIDUES IN LOUISIANA, 1971-1976,
Fish and Wildlife Service, Corvallis, OR. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W79-08047

TOXICITY AND TERATOGENICITY OF AROMATIC AMINES TO XENOPUS LAEVIS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W79-08048

CLEARANCE OF ARSENIC INGESTED BY MAN FROM ARSENIC CONTAMINATED FISH,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08049

POSSIBLE ACCUMULATION OF HEAVY METALS AROUND OFFSHORE OIL PRODUCTION FACILITIES IN THE BEAUFORT SEA.
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
For primary bibliographic entry see Field 5B.
W79-08050

THE ACCUMULATION OF HEAVY METALS IN THE SUBMERGED PLANT (ELODEA NUTTALLII),
Kanagawa Prefectural Environmental Control

Center, Yokohama (Japan).
For primary bibliographic entry see Field 5B.
W79-08051

CYCLICITY OF CLADOCERAN REPRODUCTION AND ITS RELATIONSHIP TO ENVIRONMENTAL FACTORS (REVIEW),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
For primary bibliographic entry see Field 5B.
W79-08052

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO MARINE MACROBENTHOS,
Pacific Northwest Environmental Research Lab., Newport, OR. Marine Science Center.
For primary bibliographic entry see Field 5A.
W79-08053

SORPTION OF CADMIUM AND ITS EFFECT ON GROWTH AND THE UTILIZATION OF INORGANIC CARBON AND PHOSPHORUS OF TWO FRESHWATER DIATOMS,
Argonne National Lab., IL. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 5B.
W79-08055

IMPACT OF HYPOXIC CONDITIONS IN THE VICINITY OF LITTLE EGG INLET, NEW JERSEY IN SUMMER 1976,
Ichthyological Associates, Inc., Absecon, NJ.
For primary bibliographic entry see Field 5B.
W79-08056

BLOOD PROPERTIES OF RAINBOW TROUT IN ACUTE HEPATOTOXITY BY CARBON TETRACHLORIDE,
Hiroshima Univ. (Japan). School of Medicine.
For primary bibliographic entry see Field 5B.
W79-08057

THE MARINE ALGAE OF ELIE, SCOTLAND: A RE-ASSESSMENT,
Heriot-Watt Univ., Edinburgh, (Scotland). Dept. of Brewing and Biological Sciences.
For primary bibliographic entry see Field 5A
W79-08058

RESPIRATORY RESPONSES OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) TO ENVIRONMENTAL CHANGES IN TEMPERATURE AND DISSOLVED OXYGEN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 5A.
W79-08059

EFFECT OF SALINITY AND MANGANESE ON MEDIDOTEA ENTOMON,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
For primary bibliographic entry see Field 5A.
W79-08060

AN ENVIRONMENTAL CHAMBER FOR MONITORING 'IN SITU' GROWTH AND SURVIVAL OF LARVAL FISHES,
National Marine Fisheries Service, Narragansett, RI. Narragansett Lab.
For primary bibliographic entry see Field 5A.
W79-08061

EFFECTS OF DDT AND PCB'S ON SURVIVAL OF LAKE TROUT EGGS AND FRY IN A HATCHERY AND IN LAKE MICHIGAN, 1973-1976,
Michigan Dept. of Natural Resources, Marquette. Marquette Fisheries Research Station.
For primary bibliographic entry see Field 5B.
W79-08062

CRASSOSTREA VIRGINICA AS AN INDICATOR OF LEAD POLLUTION,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08064

BEHAVIORAL CHANGES IN BLUEGILL (LEPOMIS MACROCHIRUS) AS INDICATORS OF SUBLETHAL EFFECTS OF METALS,
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5A.
W79-08065

DDT INDUCED ETHOLOGICAL CHANGES IN ESTUARINE FISH,
Centre of Advanced Study in Marine Biology, Porto Novo (India).
For primary bibliographic entry see Field 5A.
W79-08066

EVIDENCE OF WEIGHT-DEPENDENT DIFFERENTIAL HEMATOLOGICAL RESPONSE TO INCREASED ENVIRONMENTAL TEMPERATURE BY CARP, CYPRINUS CARPIO,
Brock Univ., St. Catherines (Ontario). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-08067

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING PART III - THE WATER QUALITY OF TROUT CREEK, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W79-08068

MALFORMATIONS AND INHIBITORY TENDENCIES INDUCED TO BRACHYDANIO RERIO (HAMILTON-BUCHANAN) EGGS AND LARVAE DUE TO EXPOSURES IN LOW CONCENTRATIONS OF LEAD AND COPPER IONS,
Uppsala Univ. (Sweden). Inst. of Zoology.
P. T. E. Ozoh.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 668-675, 1979. 6 fig, 2 tab, 5 ref.

Descriptors: *Lead, *Copper, *Toxicity, *Fish eggs, Mutagens, *Teratogens, *Brachydanio, Embryonic growth stage, Larval growth stage, Mortality, Growth rates, Hatching, Fish physiology, Bioassay, Heavy metals, Water pollution effects.

Brachydanio rerio eggs were exposed to concentrations of 0, 36, and 72 ppb of lead and copper singly or in combination and subsequent development observed. In terms of developmental abnormalities, copper ions induced characteristic spiral malformations of the rhombencephalic region of the nervous system. Lead ions interfered with resorption of yolk in fry, erosion of tail and fin, spinal curvature and epitheliomas. In combined copper-lead experiments the copper malformation was suppressed but not those of lead. Both lead and copper ions also affected successful hatching. (Deal-EIS)
W79-08069

A COMPARISON OF THE TOXICITY OF NICKEL TO THE DEVELOPING EGGS AND LARVAE OF CARP (CYPRINUS CARPIO),
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. G. Blaylock, and M. L. Frank.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 604-611, 1979. 1 fig, 3 tab, 18 ref.

Descriptors: *Nickel, *Toxicity, *Carp, Fish eggs, Larval growth stage, Heavy metals, Life cycles, Mortality, Bioassay, Fish physiology, Sulfates, Resistance, Embryonic growth stage.

The objectives of this study were (1) to determine the toxicity of Ni to developing carp eggs and newly hatched carp larvae and (2) to compare the resistance of these two life stages to Ni toxicity. Developing eggs were exposed to selected concentrations of 3-10 ppm NiSo4. Concentrations of up to 4 ppm of Ni had no effect on the hatchability of the eggs. Beyond this level the hatching percentage decreased with increasing Ni concentrations. Carp larvae that hatched from controls were used in the experiments to determine the toxicity of Ni to the larval stage. One-day-old carp larvae were exposed to concentrations of Ni ranging from 1 to 10 ppm. As the Ni concentration increased the % survival figure decreased. The 72-h LC50 for the carp larvae was 8.46 ppm Ni as compared to 6.10 ppm for developing eggs at the time of hatching (72 h). (Deal-EIS)
W79-08070

EFFECTS OF PH ON THE BIOLOGY AND DISTRIBUTION OF EPHEMERELLA FUNERALIS (EPHEMEROPTERA),
Cornell Univ., Ithaca, NY. Dept. of Entomology and Limnology.
For primary bibliographic entry see Field 5B.
W79-08072

STRUCTURE RELATED UPTAKE OF CHLORINATED PARAFFINS IN BLEAKS (ALBURNUS ALBURNUS L),
National Swedish Environment Protection Board, Studsvik (Sweden). Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W79-08073

SPECIFIC AND NONSPECIFIC CHANGES INDUCED IN FISH BY VARIOUS TOXIC AGENTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W79-08074

DYNAMICS OF ZINC-65 SPECIFIC ACTIVITY AND TOTAL ZINC IN BENTHIC FISHES ON THE OUTER CONTINENTAL SHELF OFF CENTRAL OREGON,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 5A.
W79-08075

UPTAKE AND LOSS OF RADIOACTIVE CADMIUM BY THE SEA-SKATER HALOBATES ROBUSTUS (HETEROPTERA: GERRIDAE),
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W79-08076

INDIVIDUAL EFFECTS AND INTERACTIONS OF SALINITY, TEMPERATURE, AND ZINC ON LARVAL DEVELOPMENT OF THE GRASS SHRIMP PALAEMONETES PUGIO. I. SURVIVAL AND DEVELOPMENTAL DURATION THROUGH METAMORPHOSIS,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-08077

THE EFFECT OF NUTRITION ON THE RESPONSE OF FIELD POPULATIONS OF THE CALANOID COPEPOD ACARTIA TONSA TO COPPER,,
Environmental Research Lab., Narragansett, RI
For primary bibliographic entry see Field 5A.
W79-08079

THE EFFECTS OF MONOCHLORAMINE ON SELECTED RIVERINE FISHES,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
For primary bibliographic entry see Field 5A

W79-08081

POLONIUM-210 AND LEAD-210 IN MARINE FOOD CHAINS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5A.
W79-08082

INFLUENCE OF THREE SEDIMENT TYPES ON COPPER TOXICITY TO THE POLYCHAETE NEANTHES ARENACEODENTATA,
Environmental Research Lab. Narragansett, RI.
C. E. Pesch.
Marine Biology, Vol. 52, p 237-245, 1979. 6 fig, 4 tab, 19 ref.

Descriptors: *Copper, *Toxicity, *Sediments, *Worms, *Polychaetes, *Tissue analysis, Chemical analysis, Bioassay, Sands, Particle size, Mud, Mortality, Animal physiology, Animal metabolism.

Adult male Neathes arenaceodentata were exposed to 0.10 plus or minus 0.015 mg/l copper in the seawater of a continuous-flow bioassay system in the presence of a sand, a mud, a mixture of the sand and mud, and no sediment, to assess the influence of sediment type on Cu-induced mortality. The sediment type did influence mortality. The time to 50% mortality was 7.8 days without sediment, 36.5 days with sand, 54.5 days with the mixture, and 50.0 days with mud. There was no threshold Cu body burden that caused death. The mean Cu concentration per gram of N. arenaceodentata (less than or equal to 24 h after death) without sediment was 270 microgram, in sand 994 microgram, in the mixture 1047 microgram, and in mud 1464 microgram. The differences in the toxic responses are discussed. (Deal-EIS)
W79-08083

TRANSFER OF MERCURY FROM FISH CARCASS TO FORMICA AQUILONIA (HYMENOPTERA, FORMICIDAE),
Helsinki Univ. (Finland). Dept. of Environmental Conservation.
For primary bibliographic entry see Field 5A.
W79-08084

THE APPLICATION OF PLASTIC ENCLOSURES TO THE STUDY OF PELAGIC MARINE BIOTA,
Skidaway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5A.
W79-08085

ETHYL-P-AMINOBENZOATE (BENZOCAINE): EFFICACY AS AN ANESTHETIC FOR FIVE SPECIES OF FRESHWATER FISH,
National Fishery Research Lab., LaCrosse, WI.
V. K. Dawson, and P. A. Gilderhus.
Investigations in Fish Control, Report No. 87, 1979. 5 p, 5 tab, 22 ref.

Descriptors: *Fish physiology, *Toxicity, *Benzocaine, *Anesthetics, Ethyl-p-aminobenzoate, Rainbow trout, Brown trout, Carp, Pikes, Bass, Freshwater fish, Sockeye salmon, Chinook salmon, Lake trout, Hardness(Water), Fish behavior, Fish management, Fish eggs, Mortality, Water temperature, Hydrogen ion concentration.

Ethyl-p-aminobenzoate (benzocaine) was tested for its efficacy as an anesthetic for rainbow trout, brown trout, northern pike, carp, and largemouth bass. Concentrations of 100 to 200 mg/l were required for large adult northern pike, compared with 50 to 100 mg/l for small fish. Rates of sedation and recovery were slower in cold water than in warm water. Water hardness had little influence on the activity of benzocaine. Fish were anesthetized faster and recovered more slowly in acid than in alkaline water. Benzocaine produced deep anesthesia, but concentrations that rendered the fish handleable within 5 min were generally not safe for exposures longer than 15 min. Concentrations of benzocaine efficacious for fish were not acutely toxic to eggs of coho salmon, chinook salmon, rainbow trout, brown trout, or lake trout. Benzocaine is not registered for fishery use and is neither more effective nor safer than the registered anesthetic, tricaine methanesulfonate (MS-222). (Deal-EIS)
W79-08086

INFLUENCES OF SELECTED ENVIRONMENTAL FACTORS ON THE ACTIVITY OF A PROSPECTIVE FISH TOXICANT, 2-(DIGERANYLAMINO)-ETHANOL, IN LABORATORY TESTS,
National Fishery Research Lab., LaCrosse, WI.
For primary bibliographic entry see Field 5A.
W79-08087

TOXICITIES OF THE LAMPRICIDES 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) AND THE 2-AMINOETHANOL SALT OF 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73) TO FOUR BIRD SPECIES,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
R. H. Hudson.
Investigations in Fish Control, Report No. 89, 1979. 5 p, 2 tab, 14 ref.

Descriptors: *Organic pesticides, *Pesticide toxicity, *Birds, *Lampricides, *TFM, *Bayer 73, *Bobwhites, *Quail, Animal physiology, Mortality, Lethal limit, Lampreys, Mallard Duck, Gulls, Bioassay.

The acute oral toxicities of the lampricides 3-trifluoromethyl-4-nitrophenol (TFM) and the 2-aminoethanol salt of 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73, Bayluscide) were determined in mallards (Anas platyrhynchos), ring-billed gulls (Larus delawarensis), bobwhites (Colinus virginianus), and California quail (Lophortyx californicus). Ring-billed gulls were the most sensitive to both chemicals, alone and in combination. Field grade TFM (35% TFM in N,N-dimethylformamide) was toxic; median lethal dosages (LD50's) ranged from 250 mg/kg in gulls to 546 mg/kg in California quail. Toxicity of Bayer 73(70%) was lower; LD50 values ranged from 500 mg/kg in gulls to more than 2,000 mg/kg in mallards and bobwhites. Field grade TFM was more toxic than purified TFM(>96% pure) to mallards. Toxicity of a mixture of Bayer 73 with field grade TFM was additive in gulls and possibly additive in mallards. Mallards exposed for 48 h to drinking and swimming water containing the lampricides showed mild signs of intoxication but no birds became severly ill. On the basis of these studies, use of TFM or Bayer 73, alone or in combination, presents little toxic hazard to birds when applied in the amounts routinely used for lamprey control. (Deal-EIS)
W79-08088

THE IMPACT OF OIL POLLUTION ON INTERTIDAL MEIOFAUNA. FIELD STUDIES AFTER THE LA CORUNA-SPILL, MAY 1976,
Hamburg Univ. (Germany, F.R.). Museum of Zoology.
For primary bibliographic entry see Field 5A.
W79-08089

OVERWINTER MORTALITY OF FINGERLING SMALLMOUTH BASS IN RELATION TO SIZE, RELATIVE ENERGY STORES, AND ENVIRONMENTAL TEMPERATURE,
Toronto Univ. (Ontario). Dept. of Zoology.
J. D. Oliver, G. F. Holeton, and K. E. Chua.
Transactions of the American Fisheries Society, Vol. 108, p 130-136, 1979. 4 fig, 2 tab, 18 ref.

Descriptors: *Bass, *Mortality, *Water temperature, Bass, Seasonal, Winter, Size, Weight, Length, Fry, Cold resistance, Fish physiology, Small mouth bass, Aquiculture.

Hatchery-reared, 0+ age smallmouth bass (Micropterus dolomieui) of 55-107 mm total length were 'wintered' from September 1975 to May 1976. Temperature regimes were modelled on those of the natural environment and final temperatures were 2, 4, and 6 C. Final wintering temperature did not noticeably influence mortality rates. Long fish survived the period of low temperature better than did shorter ones. Body ratios of dry weight/wet weight, lipid weight/dry weight, and ignitable weight/dry weight all decreased during wintering, and the data indicated that there may be critical percentages of dry weight/wet weight and ignitable weight/dry weight below which these fish will die. (Deal-EIS)
W79-08090

COPPER LETHALITY TO RAINBOW TROUT IN WATERS OF VARIOUS HARDNESS AND PH,
Guelph Univ. (Ontario). Dept. of Zoology.
R. S. Howarth, and J. B. Sprague.
Water Research, Vol. 12, No. 7, p 455-462, 1978. 3 fig, 2 tab, 43 ref.

Descriptors: *Environmental effects, *Toxicity, Copper, Hydrogen ion concentration, Hardness(Water), Rainbow trout, Mortality.

Rainbow trout were tested at various combinations in waters of nominal total hardness 30, 100, and 360 mg/l as CaCO3 and pH 9, 8, 7, 6, and 5. The 96 h LC50 of total dissolved copper varied from 20 microg/l in soft acid water to 520 microg/l in hard alkaline water. One general effect was that high hardness decreased toxicity at any pH. Increasing H-ion content had a variable effect; there was a decrease, then an increase, and subsequently a decrease in copper toxicity. Larger trout were more resistant than smaller ones and this effect of size appeared to be the same at different hardness and pH combinations. Ionic copper and two ionized copper hydroxides appeared to be the toxic species of copper. (Chilton-ORNL)
W79-08124

SOME FEATURES OF FEEDING, RESPIRATION AND ENERGY CONVERSION OF DAPHNIA MAGNA,
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands). Kasteel Broekhuizen.
K. Kersting.
Hydrobiologia, Vol. 59, No. 2, p 113-120, 1978. 10 fig, 10 ref.

Descriptors: *Environmental effects, *Temperature, *Food abundance, Growth rate, Energy budget, Daphnia.

Energy conversion in Daphnia magna in relation to food concentration and temperature was investigated. Up to a critical food concentration, uptake of food was proportional to the concentration and above this concentration food uptake was constant. Growth efficiency was found to be independent of food concentration. The effect of temperature was different for high and low food concentrations. Maximal growth efficiency was observed at 10 C. Growth efficiency was negative at temperatures above 22 C. (Chilton-ORNL)
W79-08125

OPTIMUM TEMPERATURE FOR FEEDING AND GROWTH OF TILAPIA ZILLII,
California Univ., Riverside. Div. of Biological Control.
S. Platt, and W. J. Hauser.
The Progressive Fish-Culturist, Vol. 40, No. 3, p 105-107, July 1978, 1 fig, 1 tab, 6 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Growth rate, Feeding rates, Weed control.

Water temperatures in which Tilapia zillii were grown was increased about 2.6 C every two weeks from 20.8 to 34 C. The fish were fed lettuce and were weighed each time the water temperature was increased to determine their growth during that two-week period. It was found that the optimum temperature for feeding was between 28.8 and 31.4 C when the feeding rate averaged 171% of the fish's body weight of lettuce in 24 h. Fastest growth rate was at 31.4 C at which the fish averaged an increase of 3.42% of their body weight in

24 h. It was concluded that Tilapia zillii could be used as an economical method of weed control only in areas where average water temperatures do not exceed 22 C for a substantial portion of the year. (Chilton-ORNL)
W79-08126

EFFECT OF TEMPERATURE ON GROWTH AND MOLTING OF PALAEMON SERRATUS IN RELATION TO THEIR SIZE, (INFLUENCE DE LA TEMPERATURE SUR LA CROISSANCE ET LA MUE DE PALAEMON SERRATUS EN FONCTION DE LEUR TAILLE),
Centre d'Oceanographie, Marseille (France). Station Marine d' Endoume.
P. Richard.
Aquaculture, Vol. 14, No. 1, p 13-22, May 1978, 3 fig, 1 tab, 16 ref.

Descriptors: *Environmental effects, *Temperature, *Shrimp, Growth rate, Growth stages, Size.

Temperature effects on growth, molt cycle duration, and intermolt stages of Palaemon serratus in relation to body size were investigated. Optimum growth temperature was found to be 22 C. Young shrimp were less affected by temperature differences from this optimum than old ones. Extremely low temperatures depressed growth of smallest shrimp while high temperatures depressed growth of old animals. Molt cycle duration was found to be directly and linearly related to shrimp length. Increasing temperature shortened the molt cycle duration according to a hyperbolic curve and had a greater effect on largest animals. Relative durations of molt stages were not significantly affected by body size or temperature. (Chilton-ORNL)
W79-08127

TOLERANCE AUX TEMPERATURES EXTREMES DE PALAEMON SERRATUS (PENNANT): INFLUENCE DE LA TAILLE ET DE L'ACCLIMATION,
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
P. Richard.
Journal of Experimental Marine Biology and Ecology, Vol. 35, No. 2, p 137-146, November 1978, 2 fig, 1 tab, 24 ref.

Descriptors: *Environmental effects, *Temperature, Shrimp, Mortality, Size, Acclimation.

Shrimp ranging in size from 2-6 cm were acclimated to temperatures of 13, 17, 21, and 25 C and then tested for tolerance to extremes of high and low temperature. An increase in tolerance to low temperature and a decrease in tolerance to high temperature was seen with increasing body size. Upper and lower lethal temperatures of different size groups for each acclimation temperature were similar, however. It was observed that at acclimation temperatures close to tolerance limits, no advantage was gained by acclimation. Acclimation, generally had a more pronounced effect on tolerance to extreme temperatures than did body size. (Chilton-ORNL)
W79-08128

COLD TOLERANCE AT THREE SALINITIES IN POST-LARVAL PRAWNS, MACROBRACHIUM ROSENBERGII (DE MAN),
South Carolina Medical Univ. of Charleston. Dept. of Physiology.
S. U. Silverthorn, and A. M. Reese.
Aquaculture, Vol. 15, No. 3, p 249-255, 1978, 1 fig, 2 tab, 16 ref.

Descriptors: *Environmental effects, *Temperature, Salinity, Cold resistance, Invertebrates, Prawns, Acclimation.

Post-larval prawns were acclimated to 27, 22, or 16 C at salinities of 5, 8, or 14% salinity to determine whether animals reared in the laboratory at 27 C would benefit from pre-acclimation to lower temperature prior to being stocked in ponds in spring. Survival was significantly better in prawns acclimated to 22 C or below while salinity did not appear to have a significant effect on survival. Increased survival with decreased acclimation temperature was most obvious in prawns subjected to 13 C. Exposure to cold did not adversely affect later growth. (Chilton-ORNL)
W79-08130

BIOENERGETIC AND DEVELOPMENTAL RESPONSE OF A MAYFLY TO THERMAL VARIATION,
Pennsylvania Univ., Philadelphia; and Academy of Natural Sciences of Philadelphia, PA. Stroud Water Research Center.
B. W. Sweeney.
Limnology and Oceanography, Vol. 23, No. 3, p 461-477, 1978, 7 fig, 7 tab, 53 ref.

Descriptors: *Environmental effects, *Temperature, *Mayflies, Growth stages, Growth rates, Energy budget.

The effects of diel and seasonal changes in natural and experimental temperature regimes on egg development, nymphal growth and respiration, and adult fecundity of the mayfly is reported. Egg developmental time and degree-hour accumulations for eclosion were related inversely to maximum diel temperature in regimes pulsing above 14 C. Small difference between minimum and average temperatures among experimental regimes suggested that diel maximum may be the best predictor for rate of egg development at fluctuating temperatures. Subimago body size and fecundity for winter generation females were approximately double those for the summer generation. Weight-specific respiration rates of nyphs (measured at 14 constant temperatures over the range of 1 - 21 C) were found to increase with temperature but were inversely related to body size at a given temperature. Temperature-specific stimulation of metabolic processes was observed. Calculation of energy budgets for male and female nymphs reared in various thermal regimes showed that growth rates, net growth efficiencies, and production: respiration ratios of females were about double those of males. (Chilton-ORNL)
W79-08131

EFFECT OF FISH SIZE, TEMPERATURE, AND AMOUNT FED ON NUTRIENT DIGESTIBILITY OF A PELLETED DIET BY RAINBOW TROUT, SALMO GAIRDNERI,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic Biology.
J. T. Windell, J. W. Foltz, and J. A. Sarokon.
Transactions of the American Fisheries Society, Vol. 107, No. 4, p 613-616, 1978. 3 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, *Size, *Food abunance, Rainbow trout, Nutrients, Metabolism, Digestibility coefficients.

Three sizes of rainbow trout (18, 207, 586 g) were acclimated at three water temperatures (7, 11, and 15 C) and fed three meal sizes (0.4, 0.8, and 1.6% of fish weight). Digestibility coefficients for all nutrients were significantly lower for 18 g trout acclimated to 7 C than in other cases. The grand average coefficients for protein, lipid, and energy (excluding small fish at 7 C) were 93%, 89%, and 74%, respectively. These values for 18 g trout acclimated at 7 C were 20%, 9%, and 28% lower, respectively. Ration size did not significantly influence digestibility. It was concluded that the data presented resolve the question about effect of water temperature, body size and amount fed on nutrient digestibility by rainbow trout. (Chilton-ORNL)
W79-08132

WATER TEMPERATURE FLUCTUATIONS AND SEASONAL PERIODICITY OF CLADOPHORA AND POTAMOGETON IN SHALLOW RIVERS,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
S. L. Wong, B. Kirby, R. F. Kosciuw, and B. Clark.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 6, p 866-870, 1978. 5 fig, 11 ref.

Descriptors: *Environmental effects, *Temperature, *Nuisance algae, Cladophora, Aquatic weeds, Seasonal, Rivers, Pondweeds.

This paper reports investigations into the influence of water temperature on nuisance plant species under field conditions where nutrients were not limiting. In the river systems studied, a community dominated by Cladophora glomerata in late spring was usually replaced by a Potamogeton pectinatus dominated community. It was found that the tolerance limits of these two species at a given value of mean or maximum temperature vary with daily range. Temperatures of 18-22 C with daily fluctuation of <4 C supported a mixed plant community. It was concluded that temperature regulation could provide a sound basis for controlling nuisance vegetation. (Chilton-ORNL)
W79-08133

PRODUCTION OF WHITE CRAPPIE IN LAKE NASWORTHY, TEXAS
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
C. F. Yeh.
The Southwestern Naturalist, Vol. 23, No. 1, p 111-116, February 1978, 2 tab, 13 ref.

Descriptors: *Environmental effects, *Seasonal, Temperature, Growth rate, Biomass, Population, Sunfishes.

Production of white crappie (Pomoxis annularis Rafinesque) in a large reservoir (surface area of 646 ha and average depth of 2.7 m) was determined. Estimated biomass varied seasonally from 16.9 to 59.2 kg/ha. White crappie spawn in Lake Nasworthy during April and March. A smaller increase was seen in population than in biomass from April to September indicating that the increase in growth rate and decrease in mortality of older fish largely compensated for slower increase in numbers. Based on comparison with other species that predominate in temperate regions, white crappie production in this lake is in the lower end of the range of reported values. (Chilton-ORNL)
W79-08134

A COMPARISON OF PUMP SAMPLING SYSTEMS FOR LIVE ZOOPLANKTON COLLECTION,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
W. L. Yocum, M. S. Evans, and B. E. Hawkins.
Hydrobiologia, Vol. 60, No. 3, p 199-202, 1978, 2 fig, 6 ref.

Descriptors: *Environmental effects, *Zooplankton, Powerplants, Cooling water, Sampling, Equipment, Mortality.

Two different methods for filtering plankton from continuously pumped samples from the cooling water intake of a nuclear power plant are described. Observations showed that an in-line filter trap located on the suction side of the pump provided the lowest sampling mortality. (Chilton-ORNL)
W79-08135

THE INFLUENCE OF DAY LENGTH, TEMPERATURE AND SEASON ON THE HATCHING RHYTHM OF HOMARUS GAMMARUS,
Liverpool Univ., Port Erin (England). Dept. of Marine Biology.
J. R. Branford.
Journal of the Marine Biological Association of the United Kingdom, Vol. 58, No. 3, p 639-658, 15 fig, 2 tab, 13 ref.

Descriptors: *Environmental effects, *Spawning, *Lobsters, Temperature, Seasonal, Photoperiodism.

This study establishes that the endogenous component of the hatching rhythm of lobsters is in the female. Released larvae is confined to a few minutes at night and is repeated at a similar time on each night over several weeks. The time when females release larvae in light/dark regimes is

shown to be dependent upon temperature, day-length and previous photoperiodic experience. It was found that berried lobsters releasing larvae show a free-running rhythm in continuous darkness. This rhythm maintained a period close to 24 h, independent of temperature, during the summer. Period lengths recorded during the winter were found to be influenced by temperature and generally to be longer than 24 h. (Chilton-ORNL)
W79-08136

EFFECTS OF COPPER ON THE SABELLID POLYCHAETE, EUSDISTYLIA VANCOUVERI: I. CONCENTRATION LIMITS FOR COPPER ACCUMULATION,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. S. Young, R. L. Buschbom, J. M. Gurtisen, and S. P. Joyce.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 1, p 97-106, 1979. 3 fig, 4 tab, 24 ref.

Descriptors: *Environmental effects, Absorption, Copper, Invertebrates, Aquatic life, Worms, Eudistylia vancouveri, Accumulation.

In an effort to determine the level of total copper in seawater needed to sustain an increasing net tissue uptake with time, Eudistylia vancouveri were exposed to total copper concentrations of 1, 3, and 6 microg/l seawater. Analysis of internal organs showed that copper is accumulated rather than simply adsorbed to the body surface. The branchial crown concentrated more copper than the body. Accumulation was influenced by size but not sex. It was concluded that under certain conditions Eudistylia vancouveri will accumulate increasing amounts of copper with time at a concentration between 3 and 6 microg/l total copper. (Chilton-ORNL)
W79-08137

CONCENTRATIONS OF CD, CU, MN, PB, AND ZN IN FISHES IN A HIGHLY ORGANIC SOFTWATER POND,
Savannah River Ecology Lab., Aiken, SC.
J. G. Wiener, and J. P. Giesy, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 3, p 270-279, 1979. 1 fig, 7 tab, 52 ref.

Descriptors: *Environmental effects, *Trace elements, Fish, *Absorption, Water quality, Hardness(Water), Cadmium, Copper, Manganese, Lead, Zinc, Acidic water, Monitoring.

The primary objective of this study was to compare availability to fish of selected trace metals in an acidic, highly organic pond with availability in hardwater systems. Analyses of the metals were conducted on eight species of resident fishes from the pond and on stocked bluegill. Data indicated a homeostatic regulation of Cu, Mn, and Zn in resident and stocked fish. Mean axial muscle and whole body concentrations of Cu, Mn, and Zn in stocked bluegill were relatively constant approximately 200 d after stocking and did not change substantially with growth. Data indicated that Pb in this system was less available to fish than in hardwater lakes while Cd was equally as available to fish as in harder waters. It was concluded that these results have important implications for biological monitoring programs and that use of fish for such monitoring should be limited to nonessential metals that accumulate in the body with exposure. (Chilton-ORNL)
W79-08140

METABOLIC ADAPTATION OF CANCER IRRORATUS DEVELOPMENTAL STAGES TO CYCLIC TEMPERATURES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
A. N. Sastry.
Marine Biology, Vol. 51, No. 3, p 243-250, 1979. 5 fig, 2 tab, 39 ref.

Descriptors: *Environmental effects, *Temperature, *Metabolism, Cycles, Crabs.

These investigations showed generally that the metabolic rate of the developmental stages of Cancer irroratus cultured at 10 to 20 C daily cyclic and 15 C constant temperatures is modified with temperature, with higher Q10 (temperature coefficients) values (>2) at the lower temperatures, compensation with Q10's between 1 and 2 in the mid-range, and depression with Q10 values less than 1 at the higher temperatures. Compensatory response range for larvae cultured at a constant temperature of 15 C narrowed with development from first zoeae to later zoeal stages. For individuals cultured in the 10 to 20 C cyclic regime, compensatory response of first zoeae, megalops, and crab stages within the range 10 to 25 C was interrupted by a zone of thermal sensitivity between 15 and 20 C. Metabolic-temperature response of each developmental stage varied relative to the thermal culture regime as evidenced by increased respiration and metabolic rate compensation between 20 and 25 C, and by an extension of the metabolically active range towards higher temperature. (Chilton-ORNL)
W79-08143

TISSUE UPTAKE OF CADMIUM IN BROOK TROUT DURING CHRONIC SUBLETHAL EXPOSURE,
Fisheries and Marine Service, Halifax (Nova Scotia). Dept. of Environment.
G. B. Sangalang, and H. C. Freeman.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 1, p 77-84, 1979, 1 fig, 3 tab, 15 ref.

Descriptors: *Environmental effects, *Cadmium, Brook trout, Absorption.

Brook trout exposed to one ppb Cd in water accumulated Cd in gills, kidneys and liver in concentrations proportional to time of exposure. Greatest accumulation was in the gills and posterior kidneys with mean Cd concentrations showing a positive linear correlation (r= 0.99 and 0.94, respectively) with time. Accumulation of Cd in the gills appeared to be dose-dependent as well as time-dependent. Fish receiving injections of one microg/g of body weight, once a week for 16 weeks showed a definite positive accumulation in gills and posterior kidneys but with less accumulation in gills compared to fish exposed to Cd in water. (Chilton-ORNL)
W79-08147

EFFECTS OF MANGANESE, COPPER AND LEAD ON SELENASTRUM CAPRICORNUTUM AND CHLORELLA STIGMATOPHORA,
California Univ., Irvine. School of Engineering.
E. R. Christensen, and J. Scherfig.
Water Research, Vol. 13, No. 1, p 79-92, 1979. 8 fig, 10 tab. 21 ref.

Descriptors: *Environmental effects, *Metals, Toxicity, Algae, Manganese, Copper, Lead, Synergism, Antagonism.

In this study algal assays showed that a 50% reduction in the total algal cell volume of Selenastrum capricornutum in SAAM occurs in the presence of either 3.1 mg manganese/l, 85 microg copper/l, or 140 microg lead/l, added singly. 50% reduction in the total algal cell volume of Chlorella stigmatophora in 28 ppt ASW plus full SAAM nutrients occurs in the presence of either 50 mg manganese/l, 70 microg copper/l, or 700 microg lead, added singly. Data showed evidence for synergism between manganese and copper, antagonism between manganese and lead, and antagonism between copper and lead. A product model is considered to be a more reasonable reference for no-interaction than an additive model for experiments in which toxic metals are added in combination. (Chilton-ORNL)
W79-08148

TEMPERATURE AND OXYGEN-NITROGEN GAS RATIOS AFFECT FISH SURVIVAL IN AIR-SUPERSATURATED WATER,
Corvallis Environmental Research Lab., OR.
A. V. Nebeker, A. K. Hauck, and F. D. Baker.
Water Research, Vol. 13, No. 3, p 299-303, 1979, 2 fig, 2 tab, 14 ref.

Descriptors: *Environmental effects, *Temperature, *Gases, Oxygen, Nitrogen, Fish, Salmonids, Supersaturation, Mortality.

Steelhead trout smolts and juvenile chinook, coho, and sockeye salmon were tested at 8, 9, 10, 12, 15, 18, and 20 C at total gas supersaturation concentrations of 115, 116, 117, 118, and 120%. The effect of different temperatures and constant supersaturation concentration on survival of the fish varied with species. Increased temperatures caused a very significant increase in steelhead mortality, a significant increase in chinook deaths, but no significant effect on coho or sockeye mortality. Using regression models, highly significant ($P<0.001$) and significant ($P<0.005$) temperature effects were shown on steelhead and chinook, respectively. For sockeye and coho, such regressions did not show a significant effect of temperature for either the LT50 or LT20. Mixed gas tests with steelhead showed that there was a significant difference ($P<0.05$) in time to death at different O2/N2 ratios when fish were tested at the same total dissolved gas pressure. (Chilton-ORNL)
W79-08149

THE EFFECT OF INTERMITTENT CHLORINATION OF FRESHWATER PHYTOPLANKTON,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
A. S. Brooks, and N. E. Liptak.
Water Research, Vol. 13, No. 1, p 49-52, 1979, 2 fig, 15 ref.

Descriptors: *Environmental effects, *Water pollution, Chlorination, Phytoplankton, Photosynthesis.

Chlorination of Lake Michigan water for periods of 30 minutes resulted in phytoplankton showing a reduction of chlorophyll a and an increase in phaeophytin a concentrations. These effects were most pronounced at chlorine concentrations greater than 1.0 mg/l while concentrations less than about 0.1 mg/l produced only slight changes. Following an initial decrease, carbon uptake rates showed almost complete recovery after 24 h at chlorine concentrations of less than 0.1 mg/l. (Chilton-ORNL)
W79-08150

EFFECTS OF FLUCTUATING TEMPERATURE ON DURATION OF EGG DEVELOPMENT OF CHYDORUS SPHAERICUS (CLADOCERA, CRUSTACEA),
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
R. Keen.
Journal of Thermal Biology, Vol. 4, p 5-8, 1979. 2 fig, 4 tab, 11 ref.

Descriptors: *Environmental effects, *Temperature, Embryonic growth stage, Time, Zooplankton, Crustaceans, Fluctuating temperatures.

The purpose of this investigation was to determine if duration of egg development of Chydorus sphaericus was similar at constant 20 C and at fluctuating 20 C and to test for differences in duration of egg development of animals collected a few days apart from the same location. It was found that duration of egg development differed significantly under four temperature cycles, all of which averaged 20 C. Duration of development was also significantly different among groups of animals collected several days apart. Differences in duration of egg development under the four temperature cycles was explained by the Kaufmann effect. It was concluded that the prediction of development times in fluctuating temperatures is more accurate if the weighted average rate of development is used rather than the rate of development at the weighted averaged temperature. (Chilton-ORNL)
W79-08152

COLORADO RIVER DESALINATION WILD DUCK STUDY,

Colorado State Univ., Fort Collins. Dept. of Physiology and Biophysics.
D. H. Will, J. H. Abel, B. E. Russell, and K. E. Levine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 681, Price codes: A03 in paper copy, A01 in microfiche. Final Project Report, June 28, 1977. 25 p, 7 tab, 6 ref, 1 append.

Descriptors: *Saline water, *Salt tolerance, *Waterfowl, *Dehydration, *Mallard duck, Water pollution effects, Water quality, Water properties, Water temperature, Mortality, Animal behavior, Animal physiology, Paradox Valley(Colorado).

An investigation was conducted to determine the possible detrimental effects of concentrated salt water simulating approximately 70% evaporation of the Paradox Valley, Colorado, drainage on the wild mallard duck. In seven separate experiments 47 females and 47 males were exposed to a supersaturated salt or brine water pool under varying ambient air and water temperatures to determine its effect on behavior, viability, and several physiologic parameters. It was demonstrated that highly concentrated salt or brine water can be lethal to wild waterfowl. Mortality in the ducks exposed to the salt water seemed to be related to dehydration and hypothermia. When the ducks were placed in highly concentrated salt water they soon showed discomfort, and preferred to leave the saline pool when given a choice. This suggests that ducks in the wild landing on a brine pool would most likely choose to leave for a fresh water source or surrounding land. The results indicated that free access to fresh drinking water would possibly protect ducks and other waterfowl against the dehydration produced by exposure to concentrated salt water, and that supplying food during this period might be a protective measure against hypothermia. (Davison-IPA)
W79-08155

ENVIRONMENTAL REQUIREMENTS AND POLLUTION TOLERANCE OF TRICHOPTERA,
Purdue Univ., Lafayette, IN. Dept. of Entomology.
For primary bibliographic entry see Field 6G.
W79-08156

EVALUATION OF TOXIC EFFECTS OF ORGANIC CONTAMINANTS IN RECYCLED WATER,
Gulf South Research Inst., New Orleans, LA.
N. Gruener.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 379, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-78-068, December 1978. 110 p, 10 fig, 70 tab, 39 ref. 68-03-2464.

Descriptors: *Toxicity, *Wastes, *Municipal wastes, Potable water, *Tertiary treatment, *Activated carbon, Human pathology, Animal pathology, Water chemistry, Chemical reactions.

In a comprehensive series of toxicological studies evaluating the health effects of recycling water for drinking, some 400,000 liters of finished water from the Blue Plains, Washington, DC. treatment plant was concentrated down to 200 liters containing 700 mg/liter of total organic carbon (TOC). The concentrate was incorporated into a gel-type diet and fed to 900 mice in different studies extended up to 150 days. Observations of the growth rate, food intake, fertility, mutagenicity and mortality, blood physiology and biochemistry, liver function test behavior, and histopathology, showed very few differences between the experimental and control groups. No change could be related to clear pathological syndrome. A second series of experiments involved testing rodent and human cells in vitro for general toxicity, mutagenicity, and carcinogenicity. All three effects in the tissue cultures were positive, and were significantly increased by the presence of a liver activation system. It is concluded that although exposure to the concentrated recycled water for 20% of a lifespan does not lead to physiological changes in mice, the positive results from the mutagenicity and carcinogenicity studies indicate a need for further studies in this area. (Davison-IPA)
W79-08159

ENVIRONMENTAL REQUIREMENTS AND POLLUTION TOLERANCE OF PLECOPTERA,
Utah Univ., Salt Lake City. Dept. of Biology.
R. F. Surdick, and A. R. Gaufin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 862, Price codes: A19 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-062, October 1978. 423 p, 175 ref. R803537.

Descriptors: *Aquatic insects, *Aquatic biology, *Water quality, *Stoneflies, Environmental effects, Aquatic habitats, Insect behavior, Entomology, Ecology, Freshwater, Life cycles, Benthos.

Profile forms on 363 North American species of the freshwater insects of the order Plecoptera were compiled from a survey of the major literature sources in an investigation of the environmental requirements associated with these insects. The ranges of environmental conditions under which the species have been found are indicated, and the following ecological parameters are considered: pH, nutrients, organic pollution dissolved oxygen concentration, temperature, turbidity, current and general specific habitats, seasonal emergence of adults, feeding behavior, and geographical distribution. The objectives of this project are to provide a source book of information for use by water quality investigators and to establish a baseline to encourage further ecological and systematic research. (Davison-IPA)
W79-08160

ACUTE AND CHRONIC TOXICITY OF HCN TO FISH AND INVERTEBRATES,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries, and Wildlife.
L. L. Smith, Jr., S. J. Broderius, D. M. Oseid, G. L. Kimball, and W. M. Koenst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 047, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/3-79-009, January 1979. 129 p, 8 fig, 55 tab, 48 ref. R802914

Descriptors: *Toxicity, *Cyanide, *Life cycles, *Fish, *Invertebrates, *Fish eggs, Fry, Growth stages, Spawning, Juvenile fish, Freshwater fish, Minnows, Lethal limit, Water pollution effects.

Acute and chronic toxicity of hydrogen cyanide (HCN) were determined for different life stages of seven species of fish and two invertebrates in dynamic flow-through bioassays. It was found that eggs were the most tolerant stage; fry and juvenile were the least tolerant. Temperature and dissolved oxygen concentration (DO) also affect acute toxicity. Juvenile fish became more sensitive to decreasing temperature and DO while invertebrates were less sensitive to HCN with decreasing temperature. One species of invertebrate exhibited nearly the same sensitivity to HCN as the juvenile fish, but the other was more tolerant. Long-term tests with fathead minnows demonstrated that concentrations of HCN between 12.9 and 19.6 micrograms/l had no adverse effect on egg production. In chronic tests with brook trout, demonstrated on the basis of spawning success, the maximum acceptable toxicant concentration was between 5.7 and 11.2 micrograms/l of HCN. Invertebrate chronic tests showed that the highest concentration of HCN having no adverse effect was between 29 and 40 micrograms/l for Asellus, and between 16 and 21 micrograms/l for Gammarus. Existing models of multiple toxicity were used to evaluate the lethal and sublethal effects of binary toxicant mixtures on fish. Employing the toxic unit approach, it was determined that Zn-HCN and ammonia-HCN mixtures were more acutely toxic, and the Cr-HCN mixture was less toxic than what would be predicted from simply additive interaction. (Davison-IPA)
W79-08161

DETERMINATION OF HEAVY METALS AND SELENIUM IN FISH FROM UPPER AUSTRIAN WATERS -- PART 2: LEAD, CADMIUM, SCANDIUM, CHROMIUM, COBALT, IRON, ZINC AND SELENIUM (IN GERMAN),
Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie.
For primary bibliographic entry see Field 5A.
W79-08276

EFFECTS OF ORAL ADMINISTRATION OF CADMIUM ON FISH - IV EFFECTS ON ULTRASTRUCTURES OF HEPATIC AND RENAL CELLS OF THE CARP AND THE PORGY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries.
For primary bibliographic entry see Field 5A.
W79-08277

MORTALITY OF EXPERIMENTALLY DESCALED SMOLTS OF COHO SALMON (ONCORHYNCHUS KISUTCH) IN FRESH AND SALT WATER,
Fish and Wildlife Service Seattle, WA.
G. R. Bouck, and S. D. Smith.
Transactions of the American Fisheries Society, Vol. 108, p 67-89, 1979. 3 fig, 4 ref.

Descriptors: *Salmon, Coho salmon, *Freshwater, *Seawater, Salinity, Fish physiology, Animal pathology, Bioassay, Mortality, Fish migration, Estuaries, Loss of scales, Fish hatching.

Removal of slime from 25% of the body caused no deaths among smolts of coho salmon in fresh water or in seawater (28%). Removal of slime and scales from the same percentage of body area caused no deaths in fresh water, but 75% mortality within 10 days in seawater. The 10-day median tolerance limit was 10% scale removal immediately before the smolts entered seawater. Mortality was highest when the scales were removed from the area of the rib cage. Recovery of smolts in fresh water from a loss of scales that would be lethal in seawater occurred rapidly; 90% of the fish regained tolerance to seawater within 1 day. (Katz-EIS)
W79-08279

MODEL OF RAPID DETECTION OF SUBLETHAL EFFECTS OF POLLUTANTS: MODIFICATION OF AMYLASE AND TRYPSIN LEVELS OF ARTEMIA SALINA CONTAMINATED BY COPPER OR ZINC, (IN FRENCH),
Centre National pour l'Exploitation des Oceans, Paris (France); and Centre Oceanologique de Bretagne, Brest (France).
For primary bibliographic entry see Field 5A.
W79-08280

THE ISOLATION RESPONSE OF MUSSELS (MYTILUS EDULIS L.) EXPOSED TO FALLING SEA-WATER CONCENTRATIONS,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
J. Davenport.
Journal of the Marine Biological Association of the United Kingdom, Vol. 59, p 123-132, 1979. 3 fig, 2 tab, 5 ref.

Descriptors: *Mussels, *Salinity, Molluscs, Seawater, Animal behavior, Animal physiology, Environmental effects, Mytilus, Benthos, Marine benthos, Wastes, Laboratory tests, Freshwater, *Estuaries.

The salinity of the water retained within the mantle cavity of mussels after the shell valves have closed in response to falling environmental salinities is influenced by the rate of external salinity change. At high rates of salinity change the retained water salinity is significantly higher than in animals exposed to slowly changing salinities. However, the mantle fluid salinity is not primarily determined by the timing of shell valve adduction, but by closure of the exhalant siphon. Once this siphon has closed mantle cavity irrigation ceases, and a mussel can remain in a gaping, partially isolated state, for periods dependent upon the rate of external salinity change, without suffering sig-

nificant dilution of the mantle fluid. Eventually the inhalant siphon and shell valves close, but during the period of partial isolation the oxygen tension of the mantle fluid falls more slowly than in circumstances when the sequence of siphon and valve closure is rapid. It is suggested that this behaviour may give mussels a significantly increased period of oxygen availability at estuarine distribution sites. (Karz-EIS)
W79-08281

ECOLOGOBIOCHEMICAL CHARACTERISTICS OF HYDROCARBONS IN SOME MEDITERRANEAN SEA ORGANISMS,
Institute of Biology of Southern Seas, Sevastopol, (USSR).
For primary bibliographic entry see Field 5A.
W79-08282

EFFECT OF WATER SOLUBLE FRACTION OF PRUDHOE BAY CRUDE OIL ON EMBRYONIC DEVELOPMENT OF PACIFIC HERRING,
Alaska Univ., Fairbanks.
R. L. Smith, and J. A. Cameron.
Transactions of the American Fisheries Society, Vol. 108, p 70-75, 1979. 2 tab, 18 ref.

Descriptors: *Oil, *Oil pollution, Water pollution effects, Marine fish, *Herring, Alaska, Prudhoe Bay Crude, Toxicity, Bioassay, Mortality, Fish eggs, Juvenile fish, *Water soluble hydrocarbons, Pacific herring, Animal pathology, Fish reproduction.

This project sought to simulate conditions of a crude oil spill to test the effects of low boiling point, water-soluble hydrocarbon components of Prudhoe Bay crude oil on developing Pacific herring embryos. Initial hydrocarbon concentrations in the experimental containers were less than 1 microgram/g H_2O. Exposure for 48 hours led to a significantly higher incidence of gross morphological abnormalities. Exposure for 6 days resulted in 100% mortality of the fertilized embryos. Gross abnormalities usually consisted of flexures in the body which reduced or prevented locomotion. Results of scanning electron microscopy reveal other defects, such as improperly formed mouths, which adversely affect biological fitness yet are difficult to detect. Exposure for 12 hours or longer led to reduced size of newly hatched larvae, suggesting hydrocarbon exposure adversely affects embryonic metabolism. (Katz-EIS)
W79-08283

IODINE BALANCE IN RAINBOW TROUT (SALMO GAIRDNERI) AND EFFECTS OF TESTOSTERONE PROPIONATE,
Manitoba Univ., Winnipeg. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08287

EFFECTS OF THE SPAWNING MIGRATION OF THE ALEWIFE, ALOSA PSEUDOHARENGUS, ON FRESHWATER ECOSYSTEMS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5B.
W79-08289

MERCURY POLLUTION OF THE MARINE ENVIRONMENT IN THE REGION OF MARSEILLE, MEDITERRANEAN, FRANCE. PART 3-DEGREE OF CONTAMINATION BY MERCURY OF THE ECHINODERMS LIVING IN THE KELP BEDS IN THE VICINITY OF THE LARGE SEWER OF THE CITY OF MARSEILLES, (IN FRENCH),
Aix-Marseille-2 Univ. (France). Sciences de la Mer et de l'Environment.
For primary bibliographic entry see Field 5A.
W79-08290

THERMAL SHOCK EFFECTS ON LARVAE OF CADDIS FLY BRACHYCENTRUS AMERICANUS,
Environmental Protection Lab.-Duluth, MN.
J. A. Salmela, and R. L. Anderson.
Journal of the Minnesota Academy of Science, Vol. 44, p 25-27, 1978. 4 fig, 3 tab, 9 ref.

Descriptors: *Water temperature, *Aquatic insects, Benthos, Caddis flies, *Caddis fly larvae, Brachycentrus, Water pollution effects, Bioassay, Laboratory tests, Mortality, Methodology, Laboratory equipment, Thermal stress, Thermal pollution, Thermal water, *Thermal shock.

Caddis fly larvae were subjected to thermal shocks of 30-minute and 60-minute duration in June, September, and December of 1976. Temperatures at collection were 14.7, 10.4, and 1.2 C, respectively. The TL50's for both 30-minute and 60-minute shock durations ranged from 33.3 C to 34.0 C for each month, except for a 30-minute exposure in September, which had a TL50 of 34.6 C. Larvae from a December exposure were held for 16 days to observe postexposure behavior. Feeding was reduced 50 percent among specimens exposed to temperatures 1.2 C below the 30-minute TL50 and 3.6 C below the 60-minute TL50. (Katz-EIS)
W79-08291

GRASS CARP: EFFECTS OF SALINITY ON SURVIVAL, WEIGHT LOSS, AND MUSCLE TISSUE WATER CONTENT,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
M. J. Maceina, and J. V. Shireman.
The Progressive Fish Culturist, Vol. 41, p 69-73, 1979. 2 tab, 23 ref.

Descriptors: *Salinity, Toxicity, *Mortality, Bioassay, Laboratory tests, Freshwater fish, Grass carp, *Fish physiology, Estuaries, Survival, Weight loss, Muscle tissue, *Water content, Fish management, Fresh water ecosystem.

Fingerling grass carp, 100-120 mm total length, were exposed to various hypotonic and hypertonic waters to determine tolerance, body weight loss, and muscle tissue water content. After acclimation at 8.0%, LD50's for 24, 48, and 96 h were of 15.7, 15.1 and 15.1% salinity, respectively. No mortalities occurred in fish exposed at 14.0% for 96 h; at 12.0 and 14.0%, decreases of 8.5 and 11.3% in total body weight occurred. At lower salinities, declines in body weight were only 0.8%-1.7%. As salinity increased, the water content of muscle tissue declined from 80.0% in fresh water to 74.4% at 14.0%. Death at salinities higher than 14.0% was attributed to the failure of cellular processes to adjust to dehydration. (Katz-EIS)
W79-08293

EFFECTS OF SALINITY ON HATCHING SUCCESS OF THE CUI-UI,
Fish and Wildlife Service Reno, NV. Fishery Research.
D. A. Chatto.
The Progressive Fish Culturist, Vol. 41, p 82-89, 1979. 3 tab, 13 ref.

Descriptors: *Salinity, *Saline lakes, Saline water, *Salt tolerance, Nevada, Pyramid Lake, Fresh water fish, Fish eggs, Cui-ui, Fish physiology, *Fish reproduction, Fish eggs, Fish management, Laboratory tests, Bioassays.

Fertilized eggs of cui-ui were incubated in Pyramid Lake water (salinity, 5.2%), two dilutions of the lake water (salinities of 3.8 and 1.8%), and fresh well water. Experimental laboratory results indicate that some cui-ui eggs could hatch in Pyramid Lake where salinity approximates 1.8% and that hatching success would greatly diminish where the salinity approached 3.8%. Experimental data also indicated a significant decrease in egg size and mean total length of larvae as salinity increased. (Katz-EIS)
W79-08294

MEDICATION INHIBITS TOLERANCE TO SEAWATER IN COHO SALMON SMOLTS,
Fish & Wildlife Service, Seattle, WA.
G. R. Bouck, and D. A. Johnson.
Transactions of the American Fisheries Society, Vol. 108, p 63-66, 1979. 7 ref.

Descriptors: Salmon, *Coho salmon, Fish migration, *Fish diseases, Fish management, Fish establishment, Fish hatcheries, Fish parasites, Laboratory tests, Bioassay, Juvenile fish, Sea-water, Salinity, Herbicides, *2,4-D, *Simazine, Quinaldine, MS-222, *Potassium permanganate, Malachite green, Metals, *Copper sulfate.

Applications of 10 therapeutic and two anesthetic agents to healthy smolts of coho salmon by conventional methods were followed by two different posttreatment circumstances. In condition I, fish were treated and then transferred directly to 28% seawater for 10 days; in condition II, fish were treated and held in fresh water for 4 days before their medium was gradually changed over a 4-hour period to 28% seawater. In condition I, no mortality occurred among fish treated with 2,4-D, trichlorofon, simazine, quinaldine, or light to moderate dose of MS-222. About 10% mortality occurred among fish treated with formalin and nifurpirinol. High mortality in seawater followed treatments with copper sulfate, hyamine 1622, potassium permanganate, malachite green (one protocol), and heavy doses of MS-222. In condition II, mortality was reduced but still high for copper sulfate and potassium permanaganate, much lower for malachite green and hyamine 1622, and zero for the other agents. The results indicate that additional recoery time in fresh water is necessary between some treatments and exposure to salt water. (Katz-EIS)
W79-08295

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
For primary bibliographic entry see Field 5A.
W79-08296

ADSORPTION OF POLYCHLORINATED BIPHENYL ONTO SEA BED SEDIMENT, MARINE PLANKTON, AND OTHER ADSORBING AGENTS,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
Y. Hiraizumi, M. Takahashi, and H. Nishimura.
Environmental Science and Technology, Vol. 13, p 580-584, 1979. 6 fig, 2 tab, 14 ref.

Descriptors: *Polychlorinated biphenyls, PCB, *Sediment, *Marine plankton, Zooplankton, Phytoplankton, *Adsorption, Seawater, Laboratory tests, Adsorption capacity, Desorption rate, Laboratory test, Water pollution effects, Marine fish, Public health, Osaka Bay, Japan, Surfaces.

Adsorption of PCB onto sea bed sediment, sand, and previously dehydrated samples of plankton and other adsorbing agents was experimentally examined and compared with the results of field observations. Samples of zooplankton and phytoplankton were observed to reach their maximum PCB adsorption capacity within 100 to 200 min. However, the desorption rate was very slow. Batch studies, as well as field observations, indicate that PCB adsorption of various adsorbing agents correlates well with the PCB concentration in brine, and could be described by a Freundlich isotherm. The PCB concentration factors of the adsorbents were found to be inversely related to their average particle size and linearly related to their specific surface area for adsorbents of the same constituent. However, the organic content of the adsorbent also appeared to influence the PCB concentration factor. (Katz-EIS)
W79-08297

DEGRADATION OF DIAZINON BY SODIUM HYPOCHLORITE. CHEMISTRY AND AQUATIC TOXICITY,
Army Medical Bioengineering Research and Development Lab. Fort Detrick, MD.
For primary bibliographic entry see Field 5A.
W79-08298

THE IMPORTANCE OF SALINITY IN DETERMINING THE MORPHOLOGY AND COMPOSITION OF ALGAL MATS,
North Carolina Univ. at Chapel Hill. Curriculum in Marine Sciences.
For primary bibliographic entry see Field 5A
W79-08299

INTENSIVE CULTURE OF TILAPIA WITH GEOTHERMALLY HEATED WATER,
Weisbart and Weisbart, Inc., Alamosa, CO. Fish Dept.
P. C. Laurenstein.
In: Culture of Exotic Fishes Symposium Proceedings p 82-85 1978. R. O. Smitherman, W. L. Shelton, J. H. Grover, eds., Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Tilapia, *Fish farming, *Thermal water, Geothermal studies, Water temperature, Fry, Growth rates, Fish reproduction, Spawning, Water chemistry, Fish diets, Fish populations, Aquiculture.

The main features of the tilapia farm in Alamosa, Colorado are a well supplying geothermally heated water at 26 degrees C, circular steel tanks, cement raceways, earthen raceways, and a round earthen pond. The farm requires 252 liters/sec to sustain 50 tons of tilapia (Tilapia aurea) stocked at 20 to 60 kg/cu m/hr. High flow is necessary to maintain the water temperature in raceways above 24C with ambient temperature as low as -32 degrees C in winter. Important fish production indices include feed conversion of 1.5:1, daily consumption of pelleted feed at 1 to 1.5% of body weight, and growth rate of 1 to 2 g/day. Unwanted spawning is not a problem in this flow-through system. (Deal-EIS)
W79-08300

PRODUCTION OF TILAPIA IN CATFISH RACEWAYS USING GEOTHERMAL WATER,
Fish Breeders of Idaho, Inc., Buhl.
L. E. Ray.
In: Culture of Exotic Fishes Symposium Proceedings p 86-89, 1978. R. O. Smitherman, W. L. Shelton, J. H. Grover, eds., Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Tilapia, *Fish farming, *Thermal water, Aquiculture, Geothermal studies, Water temperature, Growth rates, Fish populations, Fish diets, Predation, Fish reproduction, Spawning, Idaho.

There exists a market for Tilapia zillii to clean aquatic vegetation from water impoundments. Production technology to supply large numbers of reproductive age T. zillii for early spring stocking was developed. Problems incurred in producing tilapis during the winter including timing, predation, grading, and transportation are discussed. A second potential exists in the form of the food market for tilapis. Initial market testing has been very encouraging. (Deal-EIS)
W79-08301

TILAPIA PRODUCTION IN PONDS RECEIVING SWINE WASTES,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5E.
W79-08302

ALGAE-SWINE MANURE SYSTEM FOR PRODUCTION OF SILVER CARP, BIGHEAD CARP, AND TILAPIA,
Tennessee Valley Authority, Muscle Shoals, AL.
J. J. Maddox, L. L. Behrends, C. E. Madewell, and R. S. Pile.
In: Culture of Exotic Fishes Symposium Proceedings p. 109-120, 1978. 6 tab, 14 ref. R.O. Smitherman, W. L. Shelton, J. H. Grover, eds, Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Carp, *Hogs, *Fish farming, *Fish diets, *Fish food organisms, Domestic animals, Domestic wastes, Aquiculture, Animal groupings, Number fish per acre, Nutrients, Waste disposal, Algae, Aquatic algae, Growth rates, Seasonal, Tilapia.

Growth of naturally occurring algae species as a result of swine manure fertilization has been studied. Seasonal changes in species of algae have been observed. A 5-day growth period with manure diluted 340 times and used daily has proven successful to produce plankton in the summertime. Yield trials using this algae were conducted with silver carp, bighead carp, and tilapia. Silver carp in monoculture gained 253% and had a 79% survival in a 72-day study in 1976. A polyculture yield trial (52 days) was conducted in 1977 with all three species to measure their cumulative growth when fed algae exogenously produced and fertilized with swine manure, compared to growth produced by an equivalent amount of manure introduced directly into the fish culture. Fish production was 1.8 times greater when manure was introduced directly into the fish culture. Results are discussed with respect to cultural problems encountered and the potential for using such systems in warm waters discharged at power plants. (Deal-EIS)
W79-08303

AN EVALUATION OF THE FILTER FEEDING FISHES, SILVER AND BIGHEAD CARP, FOR WATER QUALITY IMPROVEMENT,
Arkansas Game and Fish Commission, Little Rock.
S. Henderson.
In: Culture of Exotic Fishes Symposium Proceedings p. 121-136, 1978. 9 fig, 5 ref R.O. Smitherman, W. L. Shelton, J. H. Grover, eds, Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Water quality, *Waste water treatment, *Carp, Eutrophication, Fish diets, Plankton, Fish food organisms, Nutrients, Protein, Aquiculture, Sewage treatment, Fish farming, Water chemistry, Water quality control, Sewage lagoons, Oxidation lagoons, Growth rates, Nitrogen, Ammonia.

With the advent of stricter water quality standards has come the need for alternatives to expensive mechanical wastewater treatment methods. The silver (Hypophthalmichthys molitrix) and bighead carp (Aristichthys nobilis) filter feeding fishes were utilized in actual field tests to determine their capabilities in controlling excessive plankton blooms and converting nutrients found in wastewaters into usable protein. It was found that the presence of the fish did affect plankton removal and stimulate nutrient uptake. The feeding habits of these fishes make them capable of converting primary production into large amounts of fish flesh without supplemental feeding. The results of this first trial have provided the impetus for further research into this method of wastewater treatment which could be utilized in many instances, ranging from small town sewage treatment plants to lagoons receiving water discharged from fish farming operations. (Deal-EIS)
W79-08304

POLYCULTURE OF CHINESE CARPS IN PONDS WITH SWINE WASTES,
Illinois Natural History Survey, Kinmundy.
H. Buck, R. J. Baur, and C. R. Rose.
In: Culture of Exotic Fishes, Symposium Proceedings, p 144-153, 1978. 24 ref R. O. Smitherman, W. L. Shelton, J. H. Grover, Eds. Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Carp, *Hogs, *Fish farming, *Fish diets, Domestic animals, Fish populations, Number fish per acre, *Aquiculture, Animal groupings, Domestic wastes, Nutrients, Waste disposal, Cultures, Biomass, Channel catfish, Bass, Recycling, Growth rates.

Through three growing seasons swine houses were situated so that the wastes dropped directly into ponds stocked with silver carp, bighead carp, grass carp, the Israeli variety of the common carp, channel catfish, and either the northern largemouth bass, or the bluegill. Two ponds were used in 1975, four in 1976 and 1977. Two consecutive lots of pigs were fattened over each pond in the April to October period of each season. The sole addition of nutrients to the ponds were the swine wastes. Water levels were lowered at mid-season in 1975 and 1976 to improve natural circulation, and were lowered and later raised in 1977, but conditions were otherwise static, with no artificial aeration or circulation. Over growing periods of from 170 to 197 days gains in fish biomass ranged from 788 kg/ha in a control pond which received no wastes to a maximum of 4585 kg/ha. Production of bighead carp was inversely correlated with that of silver carp, but gains in biomass by Israeli carp were directly correlated with total gains made by silver carp. Evidence was gained that there is an optimum density of carps, one large enough for effective nutrient removal, and efficient protein production, but not so large as to create undesirable levels of turbidities or metabolites. A total mortality occurred in one pond in late-season, 1976, but water quality was in most cases adequate for the survival of largemouth bass, or the reproduction and survival of bluegill. (Deal-EIS)
W79-08305

CONCENTRATION OF SILVER 110M IN A MARINE FOOD CHAIN. II. UPTAKE THROUGH THE FOOD CHAIN,
Nantes Univ (France). Lab. de Biologie Marine.
For primary bibliographic entry see Field 5B.
W79-08306

HEAVY METALS IN RELATION TO THE BIOLOGY OF THE MUMMICHOG, FUNDULUS HETEROCLITUS,
Adelphi Univ., Garden City, NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08308

RESISTANCE TO CADMIUM BY PRETREATED RAINBOW TROUT ALEVINS,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
D. Pascoe, and J. H. Beattie.
Journal of Fish Biology, Vol. 14, p 303-308, 1979. 1 fig, 2 tab, 31 ref.

Descriptors: Freshwater fish, *Metals, *Cadmium, *Toxicity, Bioassay, Laboratory tests, Rainbow trout, Juvenile fish, Mortalities, Survival period, Cadmium pretreatment, Methodology, Water chemistry, Animal physiology, Acclimation.

A toxicity test with cadmium concentrations ranging from 0.1 to 100.0 mg/l Cd was used to assess the effect of cadmium pretreatment on rainbow trout alevins. The median period of survival for fish pretreated at 0.1 mg/l Cd was found to be increased at test concentrations up to 10 mg/l Cd compared with alevins pretreated with dilution water. However, at concentrations above 10 mg/l Cd pretreatment at 0.01 mg/l Cd reduced the median period of survival. (Katz-EIS)
W79-08309

STRONTIUM MARKING OF HATCHERY-REARED COHO SALMON (ONCORHYNCHUS KISUTCH, WALBAUM),
Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.
For primary bibliographic entry see Field 5A.
W79-08310

ALTERATION IN ENZYME ACTIVITIES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS EXPOSED TO ENDRIN,
D.A.V Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-08312

EFFECTS OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL ON THE MARINE ALGA, DUNALLIELA TERIOLECTA,

California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5A.
W79-08313

ENDRIN TOXICOSIS ON FEW ENZYMES IN LIVER AND KIDNEY OF CHANNA PUNCTATUS (BLOCH),
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-08315

FURTHER STUDIES ON THE TOXICITY OF DDT TO PLANARIA,
National Council for Scientific Research, Beirut (Lebanon). Marine Research Center.
For primary bibliographic entry see Field 5B.
W79-08316

THE IN VIVO EFFECT OF MERCURIC CHLORIDE ON SOME DIGESTIVE ENZYMES OF A FRESH WATER TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08317

EFFECTS OF CALCIUM ADDITION AS CA(NO3)2 ON ZINC TOXICITY TO FATHEAD MINNOWS, PIMEPHALES PROMELAS, RAFINESQUE,
North Texas State Univ., Denton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-08318

A COMPARATIVE STUDY OF THE EFFECT OF ACUTE AND CHRONIC MERCURIC CHLORIDE TREATMENT ON THE ACTIVITIES OF A FEW DIGESTIVE ENZYMES OF A TELEOST FISH, CHANNA PUNCTATUS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08319

ALKANES IN FISH FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
For primary bibliographic entry see Field 5A.
W79-08320

UPTAKE, TISSUE DISTRIBUTION, METABOLISM AND ELIMINATION N-OCTANO-1-14C-HYDROXAMIC ACID BY BROOK TROUT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-08321

MERCURIC CHLORIDE INDUCED ENZYMOLOGICAL CHANGES IN KIDNEY AND OVARY OF A TELEOST FISH, CHANNA PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-08323

EFFECTS OF LEAD NITRATE ON THE ACTIVITIES OF A FEW ENZYMES IN THE KIDNEY AND OVARY OF HETEROPNEUSTES FOSSILIS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-08324

ACCUMULATION OF POLYCHLORINATED BIPHENYL (PHENOCLOR DP6) BY ESTUARINE FISH,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W79-08325

EFFECTS OF CRUDE AND DIESEL OIL SPILLS ON PLANT COMMUNITIES AT PRUDHOE BAY, ALASKA, AND THE DERIVATION OF OIL SPILL SENSITIVITY MAPS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
D. A. Walker, P. J. Webber, K. R. Everett, and J. Brown.
Arctic, Vol. 3, p 242-259, 1978. 4 fig, 3 tab, 29 ref.

Descriptors: *Oil, *Oil spills, Water pollution effects, Alaska, Arctic, Prudhoe Bay, *Plant communities, Aquatic plants, *Plant groupings, Plant growth, Plant populations, Sedges, Willow trees, Moss, Lichens, Mortalities, Oil sensitivity maps, Crude oil, Diesel oil.

Crude oil was spilled on six of the major Prudhoe Bay plant communities at an intensity of 12 l/sq. m. The communities occurred along a topographic-moisture gradient. The reaction of the major species of the various communities was recorded one year following the spills. Sedges and willows showed substantial recovery from crude oil spills. Mosses, lichens, and most dicotyledons showed little or no recovery. On a very wet plot with standing water, the vegetation showed total recovery one year following the spill. Dry plots on the other hand, showed very poor recovery. Dryas integrifolia M. Vahl, the most important vascular species on dry sites, was killed. Identical experiments using diesel oil rather than crude oil showed all species except an aquatic moss to be killed. A sensitivity index for the communities was calculated on the basis of the percentage cover of the resistant species divided by the original total plant cover of the community. With this information an oil spill sensitivity map for an area of Prudhoe Bay was constructed using a vegetation map as a base. Using the crude oil data from Prudhoe Bay together with some from the literature, a predictive sensitivity map was also constructed for an accidental crude oil spill at nearby Franklin Bluffs. In this example all the community types are considered to have moderate to excellent recovery potential. (Katz-EIS)
W79-08326

POLYCHLORINATED BIPHENYL ACCUMULATION IN GREY MULLETS (CHELON LABROSUS): EFFECT OF AGE,
Bordeaux Univ., Talence (France). Lab. de Physiologie de la Nutrition.
For primary bibliographic entry see Field 5A.
W79-08327

ACUTE TOXICITY OF CADMIUM, COPPER, AND MERCURY TO LARVAL AMERICAN LOBSTER HOMARUS AMERICANUS,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W79-08328

MASS DEVELOPMENT OF THE PHYTOFLAGELLATE PRYMMESIUM PARVUM CARTER (HAPTOPHYCEAE) IN A COASTAL LAGOON IN THE EBRO DELTA (DESARROLLO MASIVO DEL FITOFLAGELADO PRYMNESIUM PARVUM CARTER (HAPTOPHYCEAE) EN UNA LAGUNA COSTERA DEL DELTA DEL EBRO),
Barcelona Univ. (Spain). Dept. de Ecologia.
For primary bibliographic entry see Field 5A.
W79-08330

TOXICITY OF PRUDHOE BAY CRUDE OIL TO ALSKAN ARCTIC ZOOPLANKTON,
Kansas Univ., Lawrence. Dept. of Systematics and Ecology.
W. J. O'Brien.
Arctic, Vol. 31, p 219-228, 1978. 2 tab, 2 fig, 30 ref.

Descriptors: *Oil, *Oil spill, *Toxicity, Bioassay, Laboratory test, Water pollution effects, Arctic, Alaska, Prudhoe Bay Crude Oil, *Zooplankton, Crustacean, Daphnia, Phyllopoda, Fairy shrimp, Copepoda, Methodology.

Bioassay experiments were conducted to determine the relative susceptibilities of three arctic zooplankton species to oil pollution, and the results were compared with the effects of an actual oil spill on a pond near Barrow. In both the bioassays and the pond, the addition of Prudhoe Bay crude oil was toxic to fairy shrimp (Branchionecta paladosa), which seemed most sensitive, Daphnia middendorffiana, which was next most susceptible and Heterocope septentrionalis which appeared somewhat resistant to the effects of oil. Cyclopoid copepods were the only common zooplankters able to survive the pond oil spill, and these were still present two and one half weeks after the spill. The rapid deaths of the other species, especially the branchiopods, suggest that zooplankton may be the most susceptible of all arctic freshwater organisms to oil pollution. (Katz-EIS)
W79-08331

CARP (C1-2) OVERWINTERING AND BREEDING IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
R. Trzebiatowski, J. Filipiak, and R Jakubowski.
Zeszty Naukowe Akademii Rolniczej w Szczecinie, No. 70, p 51-61, 1978. 5 fig, 1 tab, 9 ref. (English Summary).

Descriptors: *Carp, Fresh water fish, *Aquiculture, Water pollution effects, Commercial fisheries, Poland, *Thermal water, *Water temperature, *Power plants, Cooling waters, On-site-investigations, Bioassay, Growth rates, Fish farming, Fish harvest, Fish hatcheries, Fish reproduction.

Studies on carp breeding in the Dolna Odra power station cooling waters were carried out within January 12 -August 23, 1976; their aim was to prove a possibility of young carp overwintering in cages placed in a cooling canal and of reproduction over the growth season. Over the experimental period, the water temperature ranged with 3,5-33.0 degrees C, frequent and substantial changes (up to 12 degrees C) during a day having been discovered. The water pH values changed within a relatively narrow range of 7.3-8.2. The water oxygenation range was 76 - 118%, 90% being the most frequent level. Fish growth rate recorded over the winter months (till the end of April) was low and basically, between the control weighings, did not exceed 10% of fish weight. Beginning from May, the increments were higher (10-35% showing a clear relationship to the water temperature (optimal growth at 24-27 degrees C). The results obtained confirmed a possibility of using the cooling waters for carp overwintering and breeding; on account of their continuous feeding in winter , the carp reared increased their body weight and improved their condition. (Katz-EIS)
W79-08332

HYDROCARBONS AND MICROBIAL ACTIVITIES IN SEDIMENT OF AN ARCTIC LAKE ONE YEAR AFTER CONTAMINATION WITH LEAD GASOLINE,
Louisville Univ., KY. Dept. of Biology.
A. Horowitz, A. Sexstone, and R. M. Atlas.
Arctic, Vol. 31, p 180-191, 1978. 1 fig, 6 tab, 6 ref.

Descriptors: *Oil, *Oil spill, Water pollution effects, Arctic, Lake, *Lead, Metals, *Leaded gasoline, Alaska, Point Barrow, Gasoline contamination, Hydrocarbons, Sediment, Nitrogen fixation, Nitrogen fixing bacteria, Naval Arctic Research Laboratory, On-site investigation, Denitrification.

Hydrocarbons were found to persist in the sediment of an Arctic lake one year after the lake was accidentally contaminated with leaded gasoline. The contaminating gasoline was continuing to spread from the original site of contamination. High numbers of hydrocarbon utilizing microorganisms were found in the contaminated sediment. Rates of nitrogen fixation did not appear to be affected by hydrocarbon contamination, but potential denitrification activities appeared to be altered

by the gasoline. Fertilizer application resulted in a moderate decrease of hydrocarbon concentrations in the sediment. (Katz-EIS)
W79-08333

CRUDE OIL BIODEGRADATION IN ARCTIC TUNDRA PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
P. E. Bergstein, and J. R. Vestal.
Arctic, Vol. 31, p 158-169, 1978. 8 fig, 20 ref.

Descriptors: *Oil, *Oil spills, Water pollution effects, Bacteria, *Arctic, *Tundra, Ponds, *Degradation(Decomposition), Crude oil, Nutrients, Fertilizers, Phosphate, Oleophilic phosphates, Microbiology, Microorganisms, On-site-investigations, Biodegradation, Oil degrading bacteria.

The degradation of Prudhoe crude oil was studied in arctic tundra ponds. Contained subponds were treated with oil and/or oleophilic phosphate or inorganic phosphate fertilizers in an attempt to enhance the degradation of the oil by the indigenous microflora. Enumeration studies of water and sediment samples indicated that oil treatment alone did not increase numbers of total heterotrophic or oil-degrading bacteria over a short period (28 days). It was also shown that oil spilled years previously on 2 whole ponds at a high (10 l/sq m) and a low dose (0.24 l/sq m) did not alter the microflora quantitatively, except in a small core spilled with oil. Although oil alone seemed to exhibit neither stimulatory nor toxic effects, oleophilic phosphate, added weekly at a concentration of 0.1 mM, significantly stimulated the microflora in the presence or absence of oil. Since equal concentrations of inorganic phosphate failed to induce this effect, the stimulation was attributed to the hydrocarbon portion of the organic phosphate molecule. 14C-hydrocarbon mineralization studies demonstrated that the microflora would mineralize the saturate fraction of the oil before the polyaromatic fraction. It was concluded that oleophilic fertilizers may provide a useful tool to enhance the biodegradation of crude oil spilled on oligotrophic waters. (Katz-EIS)
W79-08334

EFFECT OF PETROLEUM HYDROCARBONS ON MICROBIAL POPULATIONS IN AN ARCTIC LAKE,
Marine Biological Lab. Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 5A.
W79-08335

LETHAL EFFECT OF GYMNODINIUM SP. ON THE ROTIFER, BRACHIONUS PLICATILIS (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
For primary bibliographic entry see Field 5A.
W79-08336

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES, PART I: METHODS, RATIONALE, AND DATA LIMITATIONS,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, and F. A. Morris.
Report No. EPA-600/3-79-021, March 1979. 77 p, 21 fig, 6 tab, 25 ref, 3 append.

Descriptors: *Phytoplankton, *Aquatic microbiology, *Aquatic microorganisms, *Lakes, Water quality, Eutrophication, Water chemistry, Nutrients, Bioindicators, Environment, Classification, Data collections, Data storage and retrieval, National Eutrophication Survey.

The National Eutrophication Survey (NES) sampled 815 lakes in the 48 contiguous states during the spring, fall, and summer of 1972 through 1975. To determine phytoplankton water quality relationships, the physical, chemical, and biological data measured were merged, and the environmental requirements and relative importance of phytoplankton forms were established. The methodology, rationale, output format, and data limitations of the product are presented in this report, Part 1. The physical, chemical and morphometric conditions of 250 lakes in 17 eastern states sampled during 1973 are summarized on a seasonal basis and organized according to phytoplankton numerical dominance or non-dominance and occurrence or non-occurrence. The knowledge provided in these summaries of the specific requirements or environmental limits for each taxon can be used to develop biological tools for monitoring and predicting water quality or trophic condition. (See W79-08343 and W79-08344) (Davison-IPA)
W79-08342

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES PART II: GENERA ACANTHOSPHAERA THROUGH CYSTODINIUM COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris, and M. K. Morris.
Report No. EPA-600/3-79-022, March 1979. 127 p, 2 tab, 21 ref, 1 append.

Descriptors: *Aquatic microbiology, *Phytoplankton, *Lakes, *Eutrophication, Water quality, Bioindicators, Biology, Water chemistry, Nutrient requirements, National Eutrophication Survey.

Findings for the first 54 genera of the phytoplankton detected in samples from 17 eastern and southeastern states are presented as determined from the National Eutrophication Survey conducted in 1973. The environmental requirements and relative abundance of Acanthosphaera through Cystodinium given in the appendix are a computer generated summary. (See also W79-08342) (Davison-IPA)
W79-08343

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES PART III: GENERA DACTYLOCOCCOPSIS THROUGH GYROSIGMA COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
S. C. Hern, V. W. Lambou, F. A. Morris, M. K. Morris, and W. D. Taylor
Report No. EPA-600/3-79-023, March 1979. 93 p, 2 tab, 21 ref, 1 append.

Descriptors: *Phytoplankton, *Aquatic microbiology, *Lakes, *Eutrophication, Water quality, Bioindicators, Biology, Water chemistry, Nutrient requirements, National Eutrophication Survey.

Findings for 34 genera of the phytoplankton detected in samples from 17 eastern and southeastern states are presented as determined from the National Eutrophication Survey conducted in 1973. The environmental requirements and relative abundance of Dactylococcopsis through Gyrosigma given in the appendix are a computer generated summary. (See also W79-08342) (Davison-IPA)
W79-08344

DETERMINING FISH AVOIDANCE OF POLLUTED WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
S. R. Larrick, K. L. Dickson, D. S. Cherry, and J. Cairns, Jr.
Hydrobiologia, Vol. 6, No. 3, p 257-265, 1978. 1 tab, 60 ref.

Descriptors: *Fish behavior, *Water pollution effects, *Experimental equipment, *Laboratory test, Toxicity, Water pollution, Chlorine, Minnows, Bioassay, Bioindicators, Water analysis, Water quality.

Investigators have used several laboratory techniques and experimental troughs to study the behavioral responses of fish to polluted water. The merits and shortcomings of behavioral studies are evaluated, and methods with distinct advantages are proposed in an effort towards standardization of fish avoidance studies. The designs of various experimental troughs are reviewed. These troughs fall into two categories: those producing shallow gradients, and those producing steep gradients. Experiments performed with fathead minnows in a steep gradient of hypochlorite are discussed. Fish respond in several ways once a toxicant has been perceived. In a kinesis, the simplest response, the fish's body is not oriented with respect to the source of stimulation. Taxes, more advanced movements, direct a fish toward or away from a stimulant. Stott and Cross (1973) concluded that directed action of fish dominated the response of each to low oxygen conditions. The fathead minnows demonstrated most of these behavior patterns. Selecting a method of studying fish avoidance behavior and the choice of test organisms are examined. It is concluded that few methodologies incorporate all desirable features, but the steep gradient apparatus described has many useful modifications for determining fish behavior under adverse conditions. (Davison-IPA)
W79-08351

CAMP BRANCH AND CROSS CREEK EXPERIMENTAL WATERSHED PROJECTS: OBJECTIVES, FACILITIES, AND ECOLOGICAL CHARACTERISTICS,
Tennessee Valley Authority, Muscle Shoals, AL.
J. M. Kelly.
Report Nos. EPA-600/7-79-053 and TVA/ONR-79/04, March 1979. 162 p, 14 fig, 86 tab, 15 ref, 8 append. E-AP 80 BDO.

Descriptors: *Ecosystems, *Watersheds(Basins), Ecology, Biological communities, Camp Branch Watershed, Cross Creek Watershed, Basins, Soil tests, Soil analysis, Trees, Environmental effects, Hydrology, Limnology, Biochemistry, Pollutants, Soils, Air pollution, Water pollution, Widows Creek Power Plant.

Two experimental watersheds in the eastern U.S. were used to study and evaluate the impact of antropogenic emissions on individual ecosystem processes and the integrated response of the total system. The biotic and edaphic characteristics of each study site are documented. Because of the inherent variabilities of these systems, several long- and short-term studies were integrated into the watershed approach to evaluating biogeochemical processes. The Cross Creek watershed occupies a total of 36 ha and has been subjected to about 30 years of sulfur and nitrogen input from a coal-fired power plant. The Camp Branch watershed occupies 94 ha in a relatively remote area, away from the influence of any major anthropogenic sulfur or nitrogen source. A comparative study of the two sites contributed needed information on the cycling of chemical elements in natural systems. It also enables the construction of empirical models with which to predict the ecological effects of man's activities. Data gathered can be used to guide the legislative process in determining and promulgating atmospheric emission standards. (Schaefer-IPA)
W79-08357

RUNOFF WATER QUALITY FROM VARYING LAND USES IN SOUTHEASTERN ARIZONA,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 5A.
W79-08372

TRACE METALS AND MARINE PRODUCTION PROCESSES. PROCEEDINGS OF A WORKSHOP HELD AT THE PACIFIC MARINE ENVIRONMENTAL LABORATORY FEBRUARY 28 - MARCH 2, 1978,
National Ocean and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
NOAA Special Report, January 1979. 27 p, 1 tab, 70 ref. Also as Pacific Marine Environmental Laboratory Contribution No. 385.

Descriptors: *Estuaries, *Ecosystems, *Coasts, *Water pollution effects, Metals, Toxicity, Analyt-

ical techniques, Pollutant identification, Trace metals.

As part of a program studying the long-range effects of pollution the Pacific Marine Environmental Laboratory, one of the Environmental Research Laboratories of NOAA, conducted a workshop to prepare recommendations for research on the effects of trace metals on estuarine and coastal ecosystems. The significant recommendations are the following: (1) laboratory studies should concentrate on developing analytical procedures for determining the concentrations and principal species of trace metals in coastal waters and producing dose-response curves for different biological species exposed to selected metal species; (2) field studies should be devoted to determining actual concentrations and speciation of trace metals and exchanges of these trace metals between dissolved and particulate phases, and the effect of specific trace metal species on the species succession of natural populations of marine phytoplankton; and (3) chemical models should be developed to predict the effects of anthropogenic inputs of trace metals to coastal waters. (NOAA)
W79-08381

BACTERIA CRITERIA,
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08403

OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1977.
Energy and Natural Resources Committee (U.S. Senate), Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08404

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 4C.
W79-08425

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08428

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX L--WATER POLLUTION CONTROL,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 5A.
W79-08445

CONTROL OF FOULING ORGANISMS IN ESTUARINE COOLING WATER SYSTEMS BY CHLORINE AND BROMINE CHLORIDE,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton, and S. L. Margrey.
Environmental Science & Technology, Vol. 13, No. 6, p 684-689, 1979. 6 fig, 2 tab, 30 ref.

Descriptors: *Chlorine, *Chlorination, *Bromine, *Chesapeake Bay, *Toxicity, Bioassay, Fouling benthos, Animal communities, *Power plants, Halogens, Water pollution effects, Fouling communities, Water quality, Bromine chloride, Intermitent chlorination, On-site-investigations, Maryland.

The relative antifouling effectiveness of chlorine and bromine chloride under intermittent and continuous modes of application in low velocity flow areas was evaluated at an estuarine power plant located on the Chesapeake Bay. No significant difference in the control of fouling organisms was found on the average between similar concentrations of chlorine and bromine chloride. Significant differences in fouling were found between intermittent and continuous halogenation on both clean and prefouled surfaces. Continuous halogenation was more effective over an entire fouling season in controlling primary, secondary, and adventitious fouling communities than intermittent halogenation for periods up to 2 h per day. Continuous halogenation at 0.3 mg/L total residual halogen was more effective than 0.1 mg/L total residual halogen during late spring and summer; no difference was found between the two concentrations during the early fall. (Katz-EIS)
W79-08449

CADMIUM BIOACCUMULATION ASSAYS. THEIR RELATIONSHIP TO VARIOUS IONIC EQUILIBRIA IN LAKE SUPERIOR WATER,
Environmental Research Lab.-Duluth, MN.
J. E. Poldoski.
Environmental Science & Technology, Vol. 13, No. 6, p 701-706, 1979. 1 fig, 5 tab, 26 ref.

Descriptors: *Metals, *Cadmium, *Zooplankton, *Daphnia, *Bioaccumulation, Water quality, Chemical analysis, *Chemical properties, Chemical reactors, Humic acids, Bioaccumulated cadmium, Complexing agents, Bioassay, Laboratory tests, Ions, *Lake Superior, Water pollution effects, Metal uptake, Methodology.

The potential use of bioaccumulation by Daphnia magna as an analytical tool in studying properties of various aqueous cadmium forms is described. Selected aquatic chemical factors affecting cadmium residues were determined for organisms exposed to cadmium in the absence and presence of various organic and inorganic chemicals, some capable of strongly complexing cadmium. Without any added complexing agents, steady-state relationships were observed between total aqueous cadmium concentrations and bioaccumulated cadmium (0.09-3.2 micrograms wet weight) within 2-4 days of exposure. Residues were a nonlinear function of the concentration. The presence of humic acid, pyrophosphate, or aminopolycarboxylic acids, at sufficient concentrations to maximize complexation, was effective - to various degrees-in reducing cadmium uptake. However, cadmium in the presence of diethyldithiocarbamate bioaccumulated to a greater degree than in its absence. (Katz-EIS)
W79-08450

THE STRUCTURE OF MEIOFAUNA COMMUNITIES,
Oslo Univ. (Norway). Inst. for Marine Biology.
For primary bibliographic entry see Field 5A.
W79-08451

IMPINGEMENT SAMPLING FREQUENCY. A MULTIPLE POPULATION APPROACH,
Lawler, Matusky, and Skelly, Tappan, NY.
For primary bibliographic entry see Field 5A.
W79-08452

DETERMINATION OF SEVERAL INDUSTRIAL AROMATIC AMINES IN FISH,
Food and Drug Administration Washington, DC. Div. of Chemical Technology.
For primary bibliographic entry see Field 5A.
W79-08453

THE RECOVERY AND HEMATOLOGICAL REHABILITATION OF CHLORINE STRESSED ADULT RAINBOW TROUT (SALMO GAIRDNERI),
Consumers Power Co., Jackson, MI. Dept. of Environmental Services.
I. H. Zeitoun.
Environmental Biology of Fishes, Vol. 3, No. 4, p 355-359, 1978. 3 tab, 24 ref.

Descriptors: *Chlorine, *Toxicity, Bioassay, Mortality, Fish physiology, Rainbow trout, Freshwater fish, *Fish blood, Hematology, Stress, Hemolysis, Plasma electrolytes, *Water temperature, Laboratory test, Total residual chlorine, Water pollution effects.

The ability of adult trout (Salmo gairdneri) to recover from acute chlorine exposure was tested Six separate tests were carried out in duplicate. Blood was collected from each duplicate group of fish at the beginning of the test, at the appearance of the chlorine-distress symptoms, and at 24 and 48 h after exposures. The total residual chlorine (TRC) concentrations used in these six tests were 1.67, 3.50, 1.10, 1.25, 1.02 and 0.0 mg/l, at water temperatures of 13.5, 14.6, 17.2, 22.6, 23.0 and 26.0 degrees C, respectively. The cumulative fish mortality for these six tests at 48 h after exposure were 11.5, 100, 0.0, 67.1, 36.1 and 100 percent. Blood of chlorine stressed fish exhibited signs of hemoconcentration and hemolysis. All blood parameters with the exception of hemolysis returned to control levels within 24 hours after exposure. High TRC concentrations in the range of 3.5 mg/l at 14.0 degrees C, and TRC of 1.25 and 1.02 mg/l TRC at 23 degrees C, significantly diminished the rainbow trout recovery. (Katz-EIS)
W79-08454

LONG-TERM EFFECTS OF ZINC EXPOSURES ON BROOK TROUT (SALVELINUS FONTINALIS),
Environmental Research Lab.-Duluth, MN.
G. W. Holcombe, D. A. Benoit, and E. N. Leonard.
Transactions of the American Fisheries Society, Vol. 108, p 76-87, 1979. 2 fig, 3 tab, 38 ref.

Descriptors: *Metals, *Zinc, Water pollution effects, *Path of pollutants, Brook trout, Fresh water fish, *Lake Superior, Bioassay, Laboratory tests, Fish eggs, Juvenile fish, Maximum accepted toxicant concentration, Water quality, Zinc loss, Tissue concentrations.

Exposure of three generations of brook trout (Salvelinus fontinalis) to zinc concentrations ranging from 2.6 to 534 micrograms/liter produced no significant harmflu effects. During a separate exposure of embryos and larvae, 1,368 micrograms Zn/liter significantly reduced both embryo and 12-week larval survival. An additional partial chronic exposure also resulted in signifantly reduced egg chorion strength and embryo survival at 1,360 micrograms Zn/liter. The maximum acceptable toxicant concentration (MATC) for brook trout exposed to zinc in Lake Superior water (hardness = 45.4 mg/liter as CaCO3; pH = 7.0-7.7). Brook trout gill, liver, kidney, and opercular bone tissues accumulated the greatest amounts of zinc. Edible muscle tissue did not accumulate zinc. Zinc loss from gill and liver from first-generation trout transferred to control water for 12 weeks was 55% and 59%, respectively, based on the total micrograms of zinc per whole tissue. Zinc in kidney tissue (based on the total micrograms of zinc per whole tissue) increased 192%, however, during the 12 weeks in control water. (Katz-EIS)
W79-08455

ARSENIC CONCENTRATIONS IN WATER AND FISH FROM CHAUTAUQUA LAKE, NEW YORK,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08456

MERCURY IN HERONS, EGRETS, AND THEIR FOODS,
Ohio Cooperative Wildlife Research Unit, Columbus.
R. D. Hoffman, and R. D. Curnow.
Journal of Wildlife Management, Vol. 43, No. 1, p 85-93, 1979. 5 tab.

Descriptors: *Mercury, Metals, Water pollution effects, Food chain, *Lake Erie, Freshwater fish, *Water birds, Great Blue Heron, Black-Crowned Night Heron, Great Egret, Tissue concentration, Trophic level, Food chain, Food habits, Food items, Public health.

Mercury concentration levels were measured in herons and egrets and their foods collected in the southwestern Lake Erie region. We analyzed primary wing feathers, breast muscle, liver and brain tissues from 42 great blue herons, 44 black-crowned night herons, and 43 great egrets. Concentrations were higher in island nesting birds than birds collected at the Winous Point Shooting Club, with primary wing feathers the highest, followed by liver, breast muscle, and brain tissues. Mercury levels in breast muscle, liver and brain tissue of adult birds correlated ($P<0.01$) within each population. Tissues of adult birds exhibited higher ($P<0.05$) mercury concentrations than did tissues from nestlings of the same population. An importance index for each population of birds showing the significance of individual food items as sources of mercury indicated that birds nesting on West Sister Island acquired mercury from fish species found more frequently in Lake Erie than in marshes. (Katz-EIS)
W79-08457

EFFECTS OF ALDRIN EXPOSURE ON SNOW GEESE IN TEXAS RICE FIELDS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
E. L. Flickinger.
Journal of Wildlife Management, Vol. 43, No. 1, p 94-101, 1979. 3 tab, 15 ref.

Descriptors: *Water birds, *Mortality, Toxicity, On-site-investigation, Pesticides, Aldrin, *Chlorinated hydrocarbon pesticides, Public health, *Snow geese, Texas, Garwood Prairie, Agricultural chemicals, Rice fields, Pesticide residues.

In 1972 and 1974, 112 dead or moribund snow geese (Chen c. caerulescens), mostly immature white-phase males, were found in a study area on the Garwood Prairie, Texas. Dying geese were observed within 2 days after rice fields planted with aldrin-treated seed were flooded by heavy rains on 21 March 1972 and 25 March 1974. Brains from 8 snow geese that were moribund when found contained an average of 8.2 ppm (4.9-14.0 ppm) of dieldrin (a metabolite of aldrin); brains of 14 geese found dead contained an average of 14.1 ppm (2.1-31 ppm). Because no mortalities occurred in 1973 when aldrin-treated rice seed was flooded after all geese had migrated or in 1975 and 1976 after the treatment of rice seed with aldrin was suspended, it appears certain that aldrin caused the mortalities. (Katz-EIS)
W79-08458

EFFECT OF L-DOPA, BROMOCRIPTON AND LERGOTRILE ON PROLACTIN CELL ACTIVITY AND HYDROMINERAL REGULATION IN YEARLING COHO SALMON, ONCORHYNCHUS KISUTCH,
Guelph Univ. (Ontario). Dept. of Zoology.
J. F. Leatherland.
Environmental Biology of Fish, Vol. 3, No. 4, p 385-388, 1978. 1 fig, 1 tab, 19 ref.

Descriptors: *Coho salmon, *Fish physiology, *Biochemistry, Fish behavior, Fish migration, Freshwater fish, Osmosis, Osmotic pressure, L-DOPA, Bromocripton, Lergotrile, Fish hatchery, Chemical analysis, Salmonids, Ontario, Bioassay, Laboratory tests, Water pollution effects, Prolactin.

The prolactin inhibiting substances L-DOPA, Lergotrile and Bromocripton appeared to reduce the secretory activity of the prolactin cells in coho salmon (Oncorhynchus kisutch) yearlings acclimated to distilled water and effected significant reductions in plasma osmotic pressure and plasma Na+ and/or Cl- concentrations. This suggests that in coho salmon prolactin is involved in osmotic or ionic homeostasis in hyposmotic environments in a manner similar to that in other teleosts. (Katz-EIS)
W79-08459

STRUCTURE OF THE YOLKSAC EPITHELIUM AND GILLS IN THE EARLY DEVELOPMENTAL STAGES OF RAINBOW TROUT (SALMO GAIRDNERI) MAINTAINED IN DIFFERENT AMBIENT SALINITIES,
Guelph Univ. (Ontario). Dept. of Zoology.
A. C. Y. Shen, and J. F. Leatherland.
Environmental Biology of Fishes, Vol. 3, No. 4, p 345-354, 1978. 19 fig, 30 ref.

Descriptors: *Rainbow trout, *Salinity, Freshwater fish, Juvenile fish, Juvenile growth stage, *Fish eggs, Laboratory tests, Yolksac, Osmosis, Ambient salinity, Laboratory tests, Osmotic regulation, Embryo, Alevin, *Fish physiology.

Small numbers of 'mitochondria-rich' ('chloride') cells were found in the yolksac epithelium of rainbow trout (Salmo gairdneri) embryos just before hatching and in eleutheroembryos up to 14 days after hatching. This suggests that the yolksac epithelium may play a limited ionoregulatory role in this species. 'Mitochondria-rich' cells were also present in small numbers in the branchial epithelium of embryos just before hatching and in increasing numbers in eleutheroembryos during the first two weeks after hatching. The cells in the branchial epithelium showed marked variations in appearance, particularly in the fine structure of the tubular (smooth) endoplasmic reticulum. Few of the mitochondria-rich cells examined here had the pitted apex which is characteristic of homologous cells in other species. There appeared to be no differences in the numbers or appearance of 'mitochondria-rich' cells in embryos and eleutheroembryos reared in different ambient salinities (distilled water, 11% and 13% sea water), possibly indicating that the genesis of the ionoregulatory function of the gills has not occurred at that interval of development. (Katz-EIS)
W79-08460

GROWTH OF RAINBOW TROUT FED ON VARIOUS PORTIONS OF FOOD IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
R. Trzebiatowski, J. Domagala, J. Filipiak, and R. Jakubowski.
Zeszyty Naukowe Akademii Roliniczej w Szczecinie, No. 70, p 63-72, 1978. 3 fig, 1 tab, 16 ref. (English summary).

Descriptors: *Rainbow trout, Freshwater fish, *Aquiculture, *Water temperature, *Power plants, Cooling water, Poland, Dolna Odra Power Station, Fish growth, Fish diets, *Gas-bubble disease, Supersaturation, Fish diseases, Fish farming, Fish physiology, Hydrogen ion concentration, Water quality, Optimal diet, Water pollution effect.

Studies aimed at determining the optimal food portion in feeding rainbow trout kept in the 'Dolna Odra' power station cooling waters were carried out within Dec. 2, 1976 - April 7, 1977. The experiments were run in 4 variants, each in 3 replicates. Each cage hold 3 cubic meters of water. The juvenile fish stock, ca 20 g original individual weight was 600 ind./cubic meters. A daily food portion in each variant was 2.0, 3.5, 5.0 and 6.5% of actual fish weight. During the experimental period, water temperature, pH, and oxygen saturation ranged within 8.0-20.0 degrees C, 5.8-8.4, and 74.1-107.2%, respetively. After 127 days in culture, a mean individual fish weight increased by a factor of 3.8, 7.2, 9.4, and 9.9 in the variant I, II, III and IV, respectively. The respective values of food coefficients were: 2.37, 1.79, 1.96, 2.29. The gas disease occurring periodically in fishes caused some mortality, inversely proportional to their feeding intensity; the per cent survival was 58.82, 83.46, 89.65, and 91.08 in the variant I, II, III, and IV, respectively. The data obtained indicate the fish condition to play a considerable role in surviving the gas disease. The optimal food portion in feeding rainbow trout kept in cooling waters (14-20 degrees C) was found to be about 5% of fish weight. (Katz-EIS)
W79-08461

EFFECTS OF CRUDE OIL ON AQUATIC INSECTS OF TUNDRA PONDS,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
S. C. Mozley, and M. G. Butler.
Arctic, Vol. 31, No. 3, p 229-241, 1978. 1 fig, 2 tab, 18 ref.

Descriptors: *Oil, *Oil spill, Water pollution effects, *Arctic, *Aquatic insects, Bioassay, *Toxicity, Mortality, Canada, Ponds, Tundra, Tundra ponds, Chironimidae, Caddisflies, Stoneflies, On-site-investigation, Sampling.

Aquatic insects are numerous and important in the ecology of tundra thaw ponds, comprising most of the biomass and production. The most common types are the caddisflies Asynarchus and Micrasema, the stonefly Nemoura, the beetle Agabus and especially larvae of the fly family Chironomidae. Studies in vitro showed no detectable mortality of these insects at doses of oil up to 1.5 l/sq. m. Prudhoe Bay crude oil. However, field experiments on two ponds with application rates of about 10 l/sq. m. (Pond E. 1970) and 0.24 l/sq. m. (Pond Omega, 1975) both indicated that selective elimination of Asynarchus and Nemoura had occurred. Chironomidae in Pond Omega displayed much lower rates of adult emergence in 1976 and 1977 than in 1975, immediately before and after oil treatment, with several species in the tribe Tanytarsini most reduced. Pond E did not show low emergence rates, but the proportion of Orthocladiinae was much higher than in reference ponds. Trichotanypus was severely reduced in Pond Omega but unusually abundant in Pond E in 1976 and 1977. Effects of oil seem to be different for different species, and occur at some point during the late larval stages of insects or at metamorphosis, but toxicity experiments did not confirm this. Oil may also interfere with reproduction in insect species which remain mainly on or near the pond surface as adults. (Katz-EIS)
W79-08462

AN ATTEMPT TO COMBINE A BIOLOGICAL PURIFICATION OF MUNICIPAL SEWAGES WITH THEIR UTILIZATION IN FISHERIES, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
L. Szlauer, and B. Szlauer.
Zeszyty Naukowe Akademii Rolniczej W Szczecinie, No. 70, p 73-83, 1978. 2 fig, 2 tab, 12 ref. (English Summary).

Descriptors: *Carp, *Daphnia, *Aquiculture, Zooplankton, Freshwater fish, Nutrients, Waste treatment, *Sewage disposal, Sewage effluent, Sewage treatment, Fish diets, Fish production, Fish harvest, Phytoplankton, Phosphates, Ammonium compounds.

A final treatment of municipal wastes of the town of Nowogard was attempted through their utilization in zooplankton and juvenile carp cultures. The culturing was carried out under laboratory conditions as well as in the open air in tanks and 1000-l ponds. In summertime, the sewage altered its original properties so that phytoplankton and Daphnia magna could live in it as early as after 10 days of retention in ponds, while after 20 days juvenile carp were able to dwell there. A mean production of D. magna kept in the sewage was 10.8 mg/l/day, which, when converted to a 1 hectare area of a 1-m deep pond gives 15.4 t possible to obtain over 5 warm months. The juvenile carp production obtained from a 1 ha and 1m deep pond after 100 days was 957 and 1450 kg. The latter figure concerns a culture in which juvenile fish were fed with zooplankton caught in another sewage pond. Reductions in nutrient contents amounting, on the average, to 74.7% phosphate, 94.2% ammonium, and 96.5% oxidation potential was found to occur in all the ponds. (Katz-EIS)
W79-08463

FINAL PURIFICATION OF EFFLUENTS FROM MINERAL FERTILIZERS PLANT IN EXPERIMENTAL PONDS DURING WINTER, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
B. Szlauer, and L. Szlauer.
Zeszyty Nawkowe Akademii Rolniczej W Szczecinie, No. 70 p 85-102, 1978. 6 tab, 10 ref. (English Summary).

Descriptors: *Nutrients, *Carp, *Daphnia, *Waste treatment, Freshwater fish, Poland, Fertilizer plant, Ponds, Reproduction, Growth rates, On-site-investigations, Industrial wastes, Zooplankton, Biomass, Water pollution effects, Aquiculture.

In the winter months of the years 1974-1977, an attempt was being made to purify in experimental ponds the effluents released by the Police Chemical Plant and, at the same time, to test a possibility of keeping zooplankton and juvenile carp under those conditions. The attempt proved successful. A concentrated sewage obtained directly from the chemical treatment plant as well as the sewage enriched with nitrogen compounds enabled phytoplankton and zooplankters, large species of Daphnia magna and D. pulex included, to develop in winter. Those cladocerans reproduced in winter, as did other zooplankters, their abundance being, however, about 10 times lower than in summer. 66.7% of juvenile carp kept in winter in the sewage survived, a mean individual weight increment reaching almost 100%; from 5.85 to 10.9 g. The planktonic organisms and carp survival in winter in the sewage ponds was made possibly by a fairly good oxygenation maintained in the ponds, particularly under ice. Those favorable conditions were occurring due to low quantities of decaying organic remains and due to a winter growth of oxygen-producing algae. A biological purification of sewage left in ponds from October through April was found to have occurred. The N-NH4+ and PO43- reductions were 0.97 and 0.07 mg/l/day, respectively. (Katz-EIS)
W79-08464

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
G. J. Finlayson, and S. H. Ashuckian.
California Fish and Game, Vol. 65, No. 2, p 80-99, 1979. 2 fig, 6 tab, 27 ref.

Descriptors: *Zinc, *Copper, Metals, *Aluminum, *Iron, Toxicity, Methodology, Laboratory tests, Rainbow trout, California, *Sacramento River, Spring Creek Diversion Dam, Shasta Lake, Mining acid water, Acid mine wastes, Fish eggs, Fish reproduction, Juvenile fish, Juvenile growth stage, Methodology, Bioassay, Water pollution effects, Water quality.

Acid mine discharges in the Spring Creek drainage, collecting behind the Spring Creek Diversion Dam, contribute large quantities of toxic zinc and coppr to the upper Sacramento River. The bioassays indicated that eggs were more resistant than alevins and fry to solutions containing both zinc and copper while solutions containing only zinc affected all stages equally. At the lower copper-to-zinc waste ratio of 1:I2, copper was absent in solution at partially toxic levels and toxicity was attributable to zinc alone, while at the higher waste ratio of 1:4, copper was present in sufficient quantities to increase the toxicity of the waste. The incipient lethal levels (10% mortality) for the period from eggs-to-fry were. .12 mg/l Zn at the lower waste ratio, and .10 mg/l Zn and 0.11 mg/l Cu at the higher waste ratio. The incipient lethal level of control fry, those which had not been previously exposed to the waste, was .03 mg/l Zn. The presence of aluminum and iron in the waste apparently did not affect the toxicity of either zinc or copper. 'Safe' levels of zinc and copper for steelhead trout are below .03 mg/l and .01 mg/l, respectively. (Katz-EIS)
W79-08465

THE EFFECTS OF OIL SPILLS ON PHYTOPLANKTON IN AN ARCTIC LAKE AND PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
M. C. Miller, V. Alexander, and R. J. Barsdate.
Arctic, Vol. 31, No. 3, p 192-218, 1978. 14 fig, 4 tab, 27 ref.

Descriptors: *Oil spills, Water pollution effects, Lakes, Ponds, Freshwater, *Arctic, Alaska, Barrow, Alaska, Algae, *Phytoplankton, *Crude oil, *Natural oil seeps, On-site-investigation, Zooplankton, Photosynthesis, Biomass, Plant populations, Bioassay, Laboratory tests.

The effect of oil spilled on Alaskan freshwater phytoplankton populations was studied in waters affected by natural oil seeps, by controlled crude oil spills in tundra thaw ponds and in a morainal lake, by subpond manipulations and bioassay experiments. The studies were carried out over a period of seven years. Regardless of dose the effects of oil were predictable in the small ponds. The zooplankton populations were virtually eliminated, and after an initial depression of primary productivity the photosynthetic rates returned to approximately prespill levels with a small increase in algal biomass. A markedly altered algal composition was an invariable effect of the response, with the elimination of a dominant flagellated form, Rhodomonas spp., in the case of the ponds. From the results of subpond manipulation experiments, evidence supports the hypothesis that elimination of grazers is the principal cause of altered species composition and increased biomass in these ponds. In out lake system there was a severe reduction in primary production during the season of the experimental spill. During the second year only the spring boom was supressed by the added oil. Bioassay experiments supported the hypothesis that in such lakes, direct inhibition of algal photosynthesis may be important, although zooplankton were greatly reduced. (Katz-EIS)
W79-08466

MICROBIOLOGICAL CYCLING OF OIL IN ESTUARINE MARSHLANDS,
Georgia State Univ., Atlanta.
D. G. Ahearn, S. A. Crow, N. H. Berner, and S. P. Meyers.
In: Estuarine Processes, Volume I, Uses, Stresses and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N. Y., 1976, p 483-492. 1 fig, 6 tab, 13 ref.

Descriptors: *Oil, *Microorganisms, *Marshes, Oil spills, Bacteria, Yeasts, Sediments, Wetlands, Rooted aquatic plants, Cellulose, Decomposing organic matter.

Indigenous microflora of sediments of Spartina marshes of the Louisiana coast include a high percentage of celluloytic bacteria and ascosporogenous yeasts (Pichia and Kluyveromyces). At sites either accidentally or experimentally inundated with crude oil, the proportion of hydrcarbon-utilizing bacteria and yeasts increased. The marsh sediments contained low populations of hydrocarbonoclastic fungi with few strains showing significant oil-emulsifying properties. In culture, representative microorganisms readily utilized alkanes from C12 to C18. Oil utilization by a representative bacterium increased significantly as incubation temperatures were raised from 10 to 30 C, whereas yeasts showed peak activity at 20 C. Oil utilization by test microorganisms was negligible at 5 C. Seeding of experimentally oiled marsh plots with a mixed culture of Candida maltosa and C. lipolytica demonstrated that these species survived in the oiled area without spreading to adjacent sites. In culture these strains gave significant emulsification of crude oil and utilized up to 90% of selected hydrocarbons. (Stihler-Mass)
W79-08474

5D. Waste Treatment Processes

A MIXING MODEL FOR A SEPARATED MECHANICAL AERATION SYSTEM,
New Jersey Dept. of Environmental Protection, Trenton. Div. of Water Resources.
S-F. Hsueh, and R. C. Ahlert.
Water Resources Bulletin, Vol. 14, No. 6, p 1404-1416, December 1978. 6 fig, 2 tab, 16 ref.

Descriptors: *Input-output analysis, *Mixing, *Waste water treatment, *Aeration, Networks, Equations, Treatment facilities, Computers, Water quality, Activated sludge, Prediction, First-order reaction, Mathematical models, Systems analysis.

An input-output method, using a network of ideal continuous stirred-tank and plug-flow tubular reactors, is adopted to analyze residence time distribution data for a separated mechanical aeration system. The usefulness of this modeling concept is enhanced by its simplicity, especially in the presence of a first-order reaction. This facilitates use of the model format for wastewater quality prediction. Moreover, first-order rate constants can also be estimated from the model, if conversions due to the reaction rate are available. (Bell Graf-Cornell)
W79-08005

REAL-TIME CONTROL OF ACTIVATED SLUDGE PROCESS,
California Univ., Los Angeles. Dept. of Engineering Systems.
M. K. Stenstrom, and J. F. Andrews.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE2, p 245-260, April 1979. 12 fig, 1 tab, 40 ref.

Descriptors: *Activated sludge process, *Simulation analysis, *Computers, *Mathematical models, Waste water treatment, Oxygen demand, Control, Environmental engineering, Sanitary engineering, Systems analysis, Equations.

A technique for real-time control of the activated sludge process using specific oxygen uptake rate (SCOUR) has been developed. Mathematical modeling and computer simulation techniques were used to develop multivariant control strategies using SCOUR and mean cell retention time as the controlled variables, and manipulating sludge recycle rate, sludge wasting rate, and wastewater feed point location. It is shown that SCOUR is a valid indicator of process efficiency and sludge activity for nonsteady state operation and that multivariant control techniques using SCOUR are superior to techniques that use only food-to-mass ratio, for mean cell retention time. It is also shown that SCOUR can be used to defect shock loads of toxic and biodegradable materials. The value of forecasting flow rates for improving control is illustrated through the use of time-series models. (Bell Graf-Cornell)
W79-08009

TOXIC SUBSTANCES IN THE EFFLUENTS OF PETROCHEMICAL PLANTS AND THEIR EFFECT ON AQUATIC ORGANISMS (REVIEW),
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5B.
W79-08045

THE ACCUMULATION OF HEAVY METALS IN THE SUBMERGED PLANT (ELODEA NUTTALLII),
Kanagawa Prefectural Environmental Control Center, Yokohama (Japan).
For primary bibliographic entry see Field 5B.
W79-08051

RAPID APPRAISAL OF THE EFFECTS OF VARIOUS SUBSTANCES ON MICROORGANISMS,
Institut National de Recherche Chimique Appliquee, Vert-le-Petit (France).
For primary bibliographic entry see Field 5B.
W79-08071

THE ROLE OF PLANT RESIDUES IN THE RETENTION OF CADMIUM IN ECOSYSTEMS,
Delaware Univ., Newark. School of Life and Health Sciences.
G. F. Somers.
Environmental Pollution, Vol. 17, p 287-295, 1978. 6 tab, 13 ref. OWRT A-038-DEL (2).

Descriptors: *Plant tissues, *Cadmium, *Adsorption, *Pollution abatement, *Water pollution control, Laboratory tests, Cation adsorption, Chemical analysis, Water pollution treatment, Deciduous trees, Decomposing organic matter.

The possible ecological role of plant residues in absorbing and retaining cadmium (Cd)++ following an environmental insult was investigated. Fresh and partially decomposed plant material was collected from an old uncultivated field, from the ground of a deciduous woodland, and from under various species of pine trees. The material was dried, finely ground, suspended in Cd (NO3)2 with added tracer amounts of 109 Cd, filtered, and counted. Total counts for all fractions were about 80,000. It was found that 70 to 85% of the total Cd was adsorbed at the lowest concentration of Cd (NO3)2, and about 30 to 40% was adsorbed at the highest concentration. The Klotz (1953) theory of multiple equilibria was modified and used to evaluate the exchange parameters of Cd++. The total number of cadmium-binding sites (n) and the intrinsic association constant (k) were determined. Changes occurring in the magnitude of n with litter decomposition seemed to be associated with changes in cellulose and lignin content. Although the specific components of the litter responsible for Cd++ adsorption have not been identified, it is concluded that the materials tested all have a significant capacity to bind this cation. It is speculated that since this material covers areas from which water supplies are drawn, it could provide a safeguard against surges of Cd++ pollution. (Davison-IPA)
W79-08163

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, EVALUATION APPENDIX.
Army Engineer District, Detroit, MI.
For primary bibliographic entry see Field 6B.
W79-08171

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY--EMPHASIS AND DIRECTION NEEDED.
Comptroller General of the United States, Washington, DC.
Report No. CED-78-177, November 13, 1978. 43 p.

Descriptors: *Water quality, *Water quality standards, *Wastewater, *Water reuse(Reclaimed water), *Waste water disposal, *Water pollution control, *Land application, Water pollution treatment, Waste water treatment, Water supply, Advanced waste treatment, Secondary treatment, Technology, Biological oxygen demand, Sludge, Federal Water Pollution Control Act, Construction grant programs.

This is a review of the apparent absence of new and innovative technologies in waste treatment projects being constructed under the Environmental Protection Agency's (EPA) construction grants program. It concentrates on the greater use of land application of wastewater and wastewater reuse and suggests ways of overcoming any obstacles which inhibit the use of these two approaches. The report describes the goals and requirements of the Federal Water Pollution Control Act of 1972, the Act's emphasis on land application and recycling and EPA's construction grant program. Conventional technology was defined as systems which have been widely used for at least 20 years to treat municipal wastewater or sludge. Any other technology or modification was classified as new, as long as it would be available for online use within ten years. A chart listing all known, new technologies and number of times used in the construction grant program is presented with an analysis of obstacles contributing to limited use of new technology. This limited use results from the fact that some new technologies provide an unnecessarily high level of treatment or are not cost effective compared to conventional technologies. The report also describes the major land application techniques--slow rate, rapid infiltration, and overland flow--and concludes that obstacles to its further use are: (1) stringent state pretreatment requirements render it too costly; (2) absence of technical and demonstration information restricts the thorough evaluation of land treatment systems; (3) limited information on health effects exists; and (4) lack of suitable land. The report offers several recommendations to overcome these obstacles. (Coan-NC)
W79-08183

METHOD FOR DECONTAMINATING WASTE MATERIAL FROM CHROMIUM MINERAL PROCESSING BY WET TREATMENT WITH SULPHUR,
Stappani (Luigi) di Stappani (P.) and Co., Milan (Italy). (Assignee).
G. Ghelli.
U.S. Patent No. 4,139,460, 7 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 643, February 13, 1979.

Descriptors: *Patents, *Industrial wastes, *Pollution abatement, Chromium, Water reuse, Alkaline earth metals, Sulfur, Recycling, Chromium mineral processing.

A method is described for decontaminating waste materials. The residue of water leaching of the roasted chromium mineral containing water soluble hexavalent chromium compounds is wet ground and classified until obtaining such a granulometrical distribution that not more than 5-10% of the particles have an average size larger than 0.4 mm, and 40-60% of the particles have an average size less than 0.8 mm, and is then subjected to wet treatment under vigorous stirring at about 100 degrees C with sulphur, in an aqueous emulsion of alkaline or alkaline-earth sulphide for 1-4 hours, the percentage of solids in the reactor being in the range of 1-60%, preferably 30-35% by weight. The reacted slurry is thickened and filtered to provide the restored or decontaminated earth and an effluent, which is partly recycled to grinding or to reaction. (Sinha-OEIS)
W79-08214

METHOD OF AND APPARATUS FOR PURIFYING WASTE WATER,
Agrotechnika Narodny Podnik, Zvolen (Czechoslovakia). (Assignee).
S. Mackrle, V. Mackrle, and O. Dracka.
U.S. Patent No. 4,139,457, 9 p, 6 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 642, February 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Water purification, Separation techniques, Filtration, Turbulence, Suspended solids, Flow, Equipment.

An improved technique for reprocessing, through a reaction zone, a portion of an agitated flow of waste water that is coupled into a wedge-shaped or frusto-conical separating zone via such reaction zone is described. A recirculation conduit, independent of an inlet aperture at the bottom of the separating zone for admiting an upward flow of water, has an inlet end is connected to the upper part of the separating zone. The outlet of the recirculation zone empties into the agitated water stream in the reaction zone. The inlet aperture at the bottom of the separating zone has a cross-sectional area which is small relative to the cross-sectional area of the separating zone and small relative to the cross-sectional area of the reaction zone. The resulting pressure drop between the inlet aperture at the bottom of the separating zone and the outlet of the recirculation conduit prevents impurities in the separation zone from returning to the reaction zone through the inlet opening. (Sinha-OEIS)
W79-08215

PROCESS FOR OXIDATION TREATMENT OF FE2+ IN WASTE WATER,
Dowa Mining Co., Ltd., Tokyo (Japan). (Assignee).
E. Yabuuchi, and K. Fukuda.
U.S. Patent No. 4,139,456, 9 p, 4 fig, 4 tab, 14 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 642, February 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Acid mine water, Acidic water, Industrial wastes, Iron bacteria, Oxidation, Diatomaceous earth.

Improved process for the oxidation of the Fe2+ in waste water is disclosed. The process if especially advantageous when applied to low pH acidic waste waters containing substantial amounts of the Fe2+ and is carried out by making use of acid-proof, porous material as a bed-material for iron bacteria to inhabit. The bed-material is suspended in the waste water to be treated and is used repeatedly in a closed circuit. An acid-resistant, porous and particulate material as used in this invention means any porous material with a surface area great enough for a large number of iron bacteria to inhabit it, and possesses the properties of readily flowing when agitated and of immediately precipitating with or without addition of coagulant when allowed to stand. It was found that F-type diatomaceous earth is especially effective. (Sinha-OEIS)
W79-08216

APPARATUS FOR REMOVING DEBRIS DURING SEWAGE TREATMENT,
A. Bologna.
U.S. Patent No. 4,138,343, 6 p, 5 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 265, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Equipment, Separation techniques, Floating debris, Endless conveyors, Rakes.

A rake-like structure is suspended near the surface of circulating liquid sewage in an open-top treatment tank to snare and retain rags and similar debris, enabling periodic removal and separate disposal of the debris. This prevents contaminated flow in valves and passages of the treating system and assures a relatively clean liquid sludge as a product of the treatment process for use as fertilizer on open land. An endless conveyor arrangement is provided to automatically pick up collected debris from a modified form of the rake-like structure and transport it to a location outside the treatment tank. (Sinha-OEIS)
W79-08219

SEWAGE AERATING STRUCTURE,
Atara Corp., Montreal (Quebec). (Assignee).
D. S. Murphy.
U.S. Patent No. 4,138,335, 7 p, 5 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 262-263, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Aeration, Bubbles, Equipment, Mixing, Impact plate.

Aeration and mixing efficiency of sewage can be increased dramatically by causing the gas-entrained sewage to collide with an impact plate, so that not only frictional shearing of the bubbles will occur, but what appears to be shattering, as well. The result is substantially more finely divided air bubbles, greatly increased in number, and therefore greater surface area which has been found to substantially increase the aeration efficiency. The effect depends on a particular relationship of distance of the impact plate from a position of maximum velocity of fluid flow of the sewage. The impact plate can be shaped in such manner as to cause movement of the sewage after impact downwardly and to the side, so that the bubbles do not immediately rise to the surface of the pond, and remain entrained for longer periods. The aerating structure comprises a flue for conducting gas entrained fluids vertically toward the top of a pond, and an impact plate fixed over the exit of the flue. The flue takes the shape of a funnel, the impact plate being spaces a specific distance from the narrowest end of the funnel. (Sinha-OEIS)
W79-08223

METHOD OF TREATING WASTE WATER OF A NUCLEAR POWER PLANT AND A SYSTEM THEREFOR,
Hitachi, Ltd. (Japan). (Assignee).
N. Kita.
U.S. Patent No. 4,138,329, 7 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 260, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial water, *Nuclear powerplants, Nuclear wastes, Radioactive wastes, Ion exchange, Recirculated water, Water reuse.

In a steam turbine system of a nuclear power plant which forms a closed loop, the waste water contaminated with radioactive impurities is decontaminated by means of ion exchange and heated to produce steam which is used as steam for providing a seal to the gland seal sections of the steam turbine. The steam is condensed back into water which is recirculated through the heating process. (Sinha-OEIS)
W79-08224

USE OF A HIGH CAPACITY AERATION COMPARTMENT IN A MULTIPLE AERATION SYSTEM,
E. Schnitzler.
U.S. Patent No. 4,138,328, 6 p, 1 fig, 13 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 260, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water purification, Activated sludge, Aeration, Equipment, Buffer vessel.

An apparatus for the purification of waste water with the activated-sludge process, comprises a buffer vessel downstream of a settling tank with a mechanical cleaner; at least one oxidation trough or vessel provided with at least one aerating device and a device for subdividing the input into the latter receptacle in the region of the aeration device; an afterclarifying receptacle; and a sludge recycling path from the afterclarifier. The buffer vessel is also provided with an aeration device and the waste water or sewage is treated there to partially reduce its biological oxygen demand. Between the buffer vessel and the oxidation receptacle, a high-efficiency stage is provided which is formed with an aeration device. The sludge recycle from the afterclarifier is introduced into the high-efficiency receptacle which is provided in the region of the aeration device of the latter with a distributor for the recycled sludge and a distributor for the discharge from the buffer vessel. (Sinha-OEIS)
W79-08225

METHOD AND APPARATUS FOR CONTINUOUSLY WASHING FIBROUS SUSPENSIONS AND CONTROLLING THE VOLUME OF WASH LIQUID,
Mo Och Domsjo A. B., Ornskoldsvik (Sweden). (Assignee).
P. A. R. Hillstrom, and L. G. Norehall.
U.S. Patent No. 4,138,313, 12 p, 1 fig, 6 tab, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 255, February 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Pulp wastes, Pulp and paper industry, Cellulose, Fibers(Plant), Equipment, Washing process.

Cellulose pulp is washed after separation of the pulping liquor at the conclusion of the digestion, before it is passed on the subsequent chemical treatment stages, such as bleaching. Dissolved impurities present in the pulping liquid after digestion include the pulping chemicals and the organic substances formed in the course of the pulping process which are water-soluble and become dissolved in the liquor. The cellulose pulp washing system is designed to remove the dissolved impurities by replacing the aqueous suspending liquor with a fresh or relatively pure aqueous suspending liquid, substantially free from such impurities, or at least having a lower content of impurities. In a continuous washing operation it is necessary to measure: (1) the volumetric flow rate of the washed suspension; (2) the liquid content of the washed suspension; and (3) the content of dissolved impurities in the suspending liquid. Then the volume amount of wash liquid added is controlled according to the washing losses to maintain washing losses within a predetermined limiting range. (Sinha-OEIS)
W79-08226

ROTATING BIOLOGICAL CONTACTOR,
FMC Corp., Chicago, IL. (Assignee).
F. F. Sako, and C. C. Pearson.
U.S. Patent No. 4,137,172, 6 p, 8 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1772, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Biological treatment, Equipment, Slime, Aeration, Aerobic conditions.

An apparatus for treating sewage provides uniquely designed thin discs that are mounted on a shaft so that the discs are immersed approximately 40% in a sewage tank. The shaft is rotated at peripheral speeds on the order of 35-75 feet per minute to alternately expose the discs to the atmosphere and the liquid wastewater in the tank providing for the growth of biological slimes on the surfaces of the discs. The discs have a corrugated configuration with the corrugations of the alternate discs disposed at ninety degrees to each other to provide maximum usable surface area in a given rotating volume while having sufficient clearance to permit unobstructive sloughing of growths. (Sinha-OEIS)
W79-08231

SEWAGE TREATMENT UNIT,
D. Foti.
U.S. Patent No. 4,139,471, 6 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 648, February 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Domestic wastes, Septic tanks, Biological treatment, Aerobic bacteria, Anaerobic bacteria, Equipment.

An apparatus transforms raw sewage into a substantially colorless and odor free effluent by the alternate action of aerobic and anaerobic bacteria as the sewage flows through a primary chamber and a secondary chamber to a settling chamber and finally to a holding tank from which the effluent discharges to a disposal area. The simple mechanical structure can be fabricated from fiberglass. (Sinha-OEIS)
W79-08233

RELEASE OF TRACE METALS BY SEWAGE SLUDGE AND THE SUBSEQUENT UPTAKE BY MEMBERS OF A TURTLE GRASS MANGROVE ECOSYSTEM,
Harbor Branch Foundation, Inc. Fort Pierce, FL.
For primary bibliographic entry see Field 5A.
W79-08296

DEGRADATION OF DIAZINON BY SODIUM HYPOCHLORITE. CHEMISTRY AND AQUATIC TOXICITY,
Army Medical Bioengineering Research and Development Lab. Fort Detrick, MD.
For primary bibliographic entry see Field 5A.
W79-08298

TILAPIA PRODUCTION IN PONDS RECEIVING SWINE WASTES,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5E.
W79-08302

ALGAE-SWINE MANURE SYSTEM FOR PRODUCTION OF SILVER CARP, BIGHEAD CARP, AND TILAPIA,
Tennessee Valley Authority, Muscle Shoals, AL.
For primary bibliographic entry see Field 5C.
W79-08303

AN EVALUATION OF THE FILTER FEEDING FISHES, SILVER AND BIGHEAD CARP, FOR WATER QUALITY IMPROVEMENT,
Arkansas Game and Fish Commission, Little Rock.
For primary bibliographic entry see Field 5C.
W79-08304

POLYCULTURE OF CHINESE CARPS IN PONDS WITH SWINE WASTES,
Illinois Natural History Survey, Kinmundy.
For primary bibliographic entry see Field 5C.
W79-08305

OVERLAND RECYCLING SYSTEM FOR ANIMAL WASTE TREATMENT,
Alcorn State Univ., Lorman, MS. Dept. of Animal Science.
H. E. Grier, and W. C. Burton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 156, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-79-029, January 1979. 82 p, 14 fig, 43 tab, 37 ref, 1 append. R-802336.

Descriptors: *Domestic animals, *Hogs, *Waste treatment, *Fertilizers, *Crop response, Effluents, Lagoons, Aerobic treatment, Biodegradation, Soil water, Soil chemistry, Soil profiles, Nitrogen, Nitrites, Nitrates, Soil properties.

The technical and economic feasibility of an alternate disposal and utilization system of animal waste management was evaluated to define techniques for deriving nutrient benefits from animal wastes and making them directly available for selected crop production. Swine wastes were disposed of in two lagoons, one anaerobic and the other aerobic, and then pumped through an overland spray system to irrigate three demonstration fields and 12 research plots. Growth responses of the animal forages grown in the demonstration fields and the vegetables grown in the research plots were assessed. Baseline data was established for soil contents and depths during the pre-application period. After each of three trial periods soil water was chemically analyzed for pH, chloride, specific conductance, nitrate, nitrite, and ammonia nitrogen. The impact of these parameters on the soil-plant-soil water system was evaluated. The results indicated that acidity in soil water was higher after the trials than in pretreatment soil analysis, because hydrogen ions were attached to clay particles in the soil and were free in soil water. Nitrogen removal from the soil increased as the application rate of nitrogen increased. Where limited nitrogen removal from the soil occurred there was very little ion removal when certain types of plants were harvested. (Davison-IPA)
W79-08354

REDUCTION OF HALOFORMS IN DRINKING WATER SUPPLIES,
Ontario Ministry of the Environment, Ottawa.
M. C. Fung.
Report No. 69. September 1978. 66 p, 12 fig, 12 tab, 21 ref, 2 append.

Descriptors: *Halogens, *Chlorine, *Coagulation, *Sedimentation, *Chlorination, Activated carbon, Chloroform, Silica, Alum, Water treatment, Potable water, Humber River, Belleville(Ontario Canada), Brantford(Ontario Canada), Cayuga(Ontario Canada), Haloforms, Organic compounds.

Two bench-scale experiments on water from Belleville, Brantford, Cayuga, and the Humber River in Ontario were conducted to determine the minimum modifications to present water treatment processes that can reduce haloform formation. Haloform precursors (post-chlorination) and haloforms (pre-chlorination) were removed using three techniques: coagulation using various types of coagulant chemicals, adsorption on granular activated carbon (GAC), and use of powered activated carbon (PAC). Haloform precursors were reduced up to 92% during a process utilizing alum coagulation with activated silica and post-chlorination. Up to 90% removal was obtained from GAC; absorption PAC was not effective as a reducer. For minimized haloform formation, alum coagulation/sedimentation should precede chlorination. Ozone, potassium permanganate, and hydrogen peroxide were studied as alternatives to chlorine in the pretreatment process; the resulting phenomena are not well understood. Overall performance of alum coagulation with activated silica in reducing the chlo-

roform precursors was unaffected by the disinfectants; disinfection efficiency, residual effects on growths in the filters, and taste and odor removal were not studied. Toxicity studies of the byproducts is suggested. (Schaefer-IPA)
W79-08355

THE CLEAN WATER ACT OF 1977,
For primary bibliographic entry see Field 6E.
W79-08413

MERCURY IN HERONS, EGRETS, AND THEIR FOODS,
Ohio Cooperative Wildlife Research Unit, Columbus.
For primary bibliographic entry see Field 5C.
W79-08457

ASSIMILATION OF SEWAGE BY WETLANDS,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
I. Valiela, S. Vince, and J. M. Teal.
In: Estuarine Processes, Volume I, Uses, Stresses, and Adaptation to the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 234-253. 5 fig, 3 tab, 88 ref.

Descriptors: *Wetlands, *Sewage treatment, *Biological treatment, Marshes, Nitrogen, Phosphorus, Metals, Lead, Zinc, Cadmium, Muds, Soils, Pesticides, Pollutants, Biomass, Rooted aquatic plants, Microorganisms, Waste water.

The effluent-properties of a variety of wetland habitats in very diverse parts of the world (salt and brackish marshes, polders, cypress, papyrus and mangrove swamps, freshwater marshes and bogs) have been studied. Although each habitat type differs, current results from marshes show that nitrogenous and phosphorus nutrients are removed from contaminated or waste waters. Heavy metals from sludges are retained by marsh muds, but the effectiveness varies considerably for different metals. Petroleum hydrocarbons accumulate in marsh muds and may be actively decomposed, particularly at lower levels of contamination. Chlorinated hydrocarbons have high affinities for marsh sediments and can be altered by microorganismal activity. There is preliminary evidence that counts of coliform bacteria may be reduced in tidal water that floods marshes. The waste-processing ability of coastal wetlands must have an upper threshold. Little is known about these upper limits but studies in chronically contaminated sites show that marshlands function well even in severly polluted areas. (Stihler-Mass)
W79-08471

5E. Ultimate Disposal Of Wastes

STRUCTURE RELATED UPTAKE OF CHLORINATED PARAFFINS IN BLEAKS (ALBURNUS ALBURNUS L),
National Swedish Environment Protection Board, Studsvik (Sweden). Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W79-08073

EFFECTS OF SUSPENDED SEDIMENTS ON PHOTOLYSIS RATES OF DISSOLVED POLLUTANTS,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-08080

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, EVALUATION APPENDIX.
Army Engineer District, Detroit, MI.
For primary bibliographic entry see Field 6B.
W79-08171

TILAPIA PRODUCTION IN PONDS RECEIVING SWINE WASTES,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
R. R. Stickney, and J. H. Hesby.
In: Culture of Exotic Fishes Symposium Proceedings p 90-96, 1978. 33 ref. R. O. Smitherman, W. L. Shelton, J. H. Grovei, eds, Fish Culture Section, American Fisheries Society, Auburn, Alabama.

Descriptors: *Tilapia, *Fish farming, *Hogs, *Fish diets, Domestic animals, Domestic wastes, Waste disposal, Recycling, Poultry, Fish populations, Growth rates, Nutrients, Sewage lagoons, Water quality, Oxidation lagoons.

The emphasis of aquacultural research on tilapia in Texas has been focused on Tilapia aurea. Preliminary investigations have been conducted to determine the protein requirements of this species, with most of the research centered on the production of T. aurea in ponds receiving swine and poultry wastes. The tolerance of T. aurea to poor water quality allows this species to survive under conditions which might be lethal to more traditional United States aquaculture fishes. Rapid growth will occur in T. aurea reared in ponds receiving input directly from swine or from primary settling ponds. Fish produced in waste lagoons can be utilized as human food or to supplement the diets of livestock. (Deal-EIS)
W79-08302

ALGAE-SWINE MANURE SYSTEM FOR PRODUCTION OF SILVER CARP, BIGHEAD CARP, AND TILAPIA,
Tennessee Valley Authority, Muscle Shoals, AL.
For primary bibliographic entry see Field 5C.
W79-08303

AN EVALUATION OF THE FILTER FEEDING FISHES, SILVER AND BIGHEAD CARP, FOR WATER QUALITY IMPROVEMENT,
Arkansas Game and Fish Commission, Little Rock.
For primary bibliographic entry see Field 5C.
W79-08304

POLYCULTURE OF CHINESE CARPS IN PONDS WITH SWINE WASTES,
Illinois Natural History Survey, Kinmundy.
For primary bibliographic entry see Field 5C.
W79-08305

THE CLEAN WATER ACT OF 1977: MIDCOURSE CORRECTIONS IN THE SECTION 404 PROGRAM,
For primary bibliographic entry see Field 6E.
W79-08421

5F. Water Treatment and Quality Alteration

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY--EMPHASIS AND DIRECTION NEEDED.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 5D.
W79-08183

WATER QUALITY STANDARDS, NAVIGABLE WATERS OF THE STATE OF MISSISSIPPI (FINAL RULE),
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08424

GROWTH OF RAINBOW TROUT FED ON VARIOUS PORTIONS OF FOOD IN COOLING WATERS, (IN POLISH),
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
For primary bibliographic entry see Field 5C.
W79-08461

AN ATTEMPT TO COMBINE A BIOLOGICAL PURIFICATION OF MUNICIPAL SEWAGES WITH THEIR UTILIZATION IN FISHERIES, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
For primary bibliographic entry see Field 5C.
W79-08463

FINAL PURIFICATION OF EFFLUENTS FROM MINERAL FERTILIZERS PLANT IN EXPERIMENTAL PONDS DURING WINTER, (IN POLISH),
Instytut Oceanografii Rybackieg, Szczcin (Poland).
For primary bibliographic entry see Field 5C.
W79-08464

5G. Water Quality Control

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
Corvallis Environmental Research Lab., OR.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 777, Price codes: A14 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-084, September 1978. Proceedings of the Third U.S.-Japan Expert's Meeting, held in Easton, MD, November 15-17, 1977. 314 p, 78 fig, 91 tab, 140 ref.

Descriptors: *Sediments, *Bottom sediments, *Toxicity, Effluents, Water pollution control, Turbidity, Dredging, Mercury, Benthos, Hydrodynamics, Pesticide residues, Pesticide removal, Bioassay, Legal aspects, Toxic substance control act, The US-Japan Ministerial Agreement.

A compilation of papers presented at the Third U.S.-Japan Expert's Meeting held November 15 through 17, 1977 in Easton, Maryland, is provided. The topics covered in the eight Japanese papers include: control of toxic effluents and management of toxic bottom sediments; present and future water pollution control projects in Japanese rivers and lakes; turbidity generated by dredging projects; recent progress in techniques for managing contaminated bottom sediments; dredging toxic sediments in Yokkaichi Port; accumulation of methyl mercury in red sea bream via the food chain; the relationship between sediments and benthos in Mikawa Bay; and a hydrodynamic study of lake pollution. The nine U.S. papers covered the following topics: the Toxic Substance Control Act affects EPA research and enforcement; mitigation feasibility for the kepone-contaminated James River; Hudson River-PCB Study; bottom sediment problems in Saginaw River and Bay, Marinette-Menominee Harbor, and Waukegan Harbor; impacts of dredged discharge into open water; bioassay for the toxicity of sediment to the marine macrobenthos; eutrophication control; dredged material regulation guidelines and criteria; and densification, treatment, and management of dredge material disposal areas. (Davison-IPA)
W79-08157

THE MISSOURI BASIN REGION'S WATER QUALITY PLANNING STRATEGY PLANNING DOSSIER. SECOND EDITION.
Federal Water Quality Control Administration, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-08174

METHOD OF AND MEANS FOR OILY WATER SEPARATION,
R. H. Murphy.
U.S. Patent No. 4,139,463, 14 p, 7 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 979, No. 2, p 644, February 13, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Oily water, Separation techniques, Flow control, Filtration, Equipment, Pumps, Bilge water, Gravity separation, Product recovery.

An oily water separator method and means uses a suction pump to withdraw oil and water from a ship's bilge or sump. To decrease emulsification of the mixture, the pump is positioned downstream of an initial filter and the separator. The pump draws the oil-water mixture by suction through a particulate filter and then into a separator. Fluid flow is slowed by the specially configured baffled separator to allow the majority of the inter-mixed oil to separate from the water by gravity before reaching the pump. The suction pump draws the water from the lower portion of the separator housing and pumps the now almost oil-free water through two additional filter stages. Means are included for reversing the pump direction to force accumulated oil floating on water from the separator housing to a holding tank. (Sinha-OEIS)
W79-08213

DEVICE FOR SEPARATING WATER FROM SUBSTANCES CONTAINED THEREIN,
Ballast-Nedam Groep N.V., Amstelveen (Netherlands; and Skimovex B. V., The Hague (Netherlands). (Assignees).
C. G. Middelbeek, T. A. Wolters, and J. B. Den Boer.
U.S. Patent No. 4,138,342, 8 p, 12 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 265, February 6, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Separation techniques, Equipment, Gravity separation.

A device is described for separating water by means of gravity segregation from water insoluble substances contained therein. The device obtains a uniform distribution of the substances over parallel channels. Displacer means are arranged which increasingly restrict the flow of liquid into the channels in the segregation direction. The displacer means are a plurality of teeth divided over the width of the separation channels and mainly extending in the piling direction of the separation channels. The width of the teeth increases in the segregation direction. If the substances are lighter than water the tooth width will increase in an upward direction, whereas in the case of heavier substances the tooth width will increase in a downward direction. However, in case large particles of heavy substances as well as of light substances occur in the water, then teeth width are preferably increased in both segregation directions. (Sinha-OEIS)
W79-08220

ENDLESS BELT CONVEYOR FOR COLLECTING FLOATING MATTER FROM WATER SURFACE,
Bridgestone Tire Co., Tokyo (Japan); and Japan Ships Machinery Development Association, Tokyo. (Assignees).
M. Suzuki, and T. Yamajo.
U.S. Patent No. 4,138,340, 11 p, 13 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 264, February 6, 1979.

Descriptors: *Patents, *Water pollution treatment, *Oil pollution, *Water quality control, Equipment, Endless belt conveyor.

An endless belt conveyor for selectively collecting high viscosity oil or coarse floating matter is disclosed. The endless belt conveyor extends between a pair of pulleys, one of which is located above water level and the other beneath water level. The conveyor comprises (1) a pair of driving bands located at widthwise ends of the conveyor, and synchronously driven together with the pulleys; (2) connection plates fixed to the driving bands at a given interval; (3) projections provided outwardly on the upper surface of each connection plate; (4) sleeves provided on the lower surface of each connection plate; and (5) flexible ropes passing through the sleeves and extending between the pulleys. (Sinha-OEIS)
W79-08222

AUTOMATED MEANS FOR HIGH VOLUME, DISCRETE DEPTH PLANKTON COLLECTING,
R. K. Hitch.
U.S. Patent No. 4,137,772, 4 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 1, p 72, February 6, 1979.

Descriptors: *Patents, *Sampling, *Plankton, Plankton nets, Equipment, Flowmeters, Flow measurement, Water quality control, Plankton collector.

A plankton collector is comprised of an open cylinder having a netting and motor with an attached propeller. The motorized propeller and netting are attached within the cylinder so that the propeller pulls water through the netting thereby concentrating the planktonic organisms. Flowmeters can easily be attached for quanitative measurement of the water flow. Two species of this invention are set forth. One species is designed to be tethered by its electrical cord in flowing water. The other species, has a portable power supply and is designed to be used by a submerged diver. (Sinha-OEIS)
W79-08228

SYSTEM FOR SEPARATING, REMOVING AND RECOVERING CONTAMINANT MATERIALS FROM A BODY OF WATER,
Oil Spill Recovery, Inc., Northbrook, IL. (Assignee).
M. D. Stagemeyer, and S. F. Allcorn.
U.S. Patent No. 4,139,470, 13 p, 21 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 2, p 647-648, February 13, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, Water quality control, Skimming, Separation techniques, Vortices, Rotational flow, Equipment, Product recovery.

A system for removing and recovering contaminants from bodies of water utilizes a channeling device moving relative to the contaminated water to funnel it to a skimming apparatus. The skimming scoop direct the collected contaminant water mixture into cylindrical separator means, also moving relative to the contaminated body of water. Creation of a separation vortex within the separator cylinder separates the contaminant in an upward direction from the downwardly discharged water. At such time the contaminant is transported to storage facilities, free of the water upon which it floated for reclamation and/or reuse. (Sinha-OEIS)
W79-08232

BARRIER FOR OIL SPILLED ON WATER,
British Petroleum Co. Ltd., London (England). (Assignee).
L. Bretherick, D. H. Desty, and M. G. Webb.
U.S. Patent No. 4,140,424, 5 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 3, p 969, February 20, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution control, Water quality control, Barriers, Obstruction to flow, Containment.

An inflatable barrier for oil spilled on water comprises at least two air chambers one of which is a pilot air tube and one or more water chambers. The walls of all the chambers are formed of flexible material. When the air chambers have been inflated with air, the water chambers have been inflated with water and the barrier placed in water, the barrier will float with part below and part above the water surface so as to impede the passage of floating oil. The pilot air tube is quickly inflated and prevents sinking or twisting of the barrier prior to inflation of the air and water chambers. (Sinha-OEIS)
W79-08236

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

REGIONAL WATER PROGRAMS IN NORTH CAROLINA,
North Carolina State Board of Health, Raleigh. Sanitary Engineering Div.
J. A. Arnold.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE2, p 183-187, April 1979.

Descriptors: *Water resources, *Programs, *Regional planning, *Water management(Applied), *North Carolina, *Regional development, Water quality, Government agencies.

The State of North Carolina has created two programs to aid in the establishment of regional water and sewer systems that have met with some success. The Regional Water Supply and Sewage Disposal Planning Program has met with financial difficulties that will require legislative action to correct. The Clean Water Bond Program, which extends construction grants to municipalities, has enabled several regional systems to gain adequate financing for construction. The separate State offices dealing with water and sewer projects should be combined, and greater support should be given to new and innovative designs for water resources systems. The State agencies could be more effective by sponsoring periodic workshops advocating regional systems and by encouraging the development of cluster systems. The ultimate goal should be the establishment of river-basin-wide regional systems. (Bell Graf-Cornell)
W79-08010

INTERACTIVE WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 994, Price codes: A05 in paper copy, A01 in microfiche. Research Technical Completion Report, January 1979. 87 p, 56 fig, 15 ref, append. OWRT C-7183(6226)(4). 14-34-0001-6226.

Descriptors: *Water resources, *Planning, *Computer graphics, *Methodology, Water quality, Floods, Reservoir operation, Optimization, Simulation analysis, Multiple-purpose, Hydrologic aspects, Mathematical models, Equations, Systems analysis, Yield-capacity.

Computer-aided design methods for water resources planning using interactive computer graphics routines have been presented. Five specific types of problems, including water quality prediction, parameter identification, flood management, reservoir simulation, and multiobjective reservoir-water supply planning were illustrated. In all cases, tablet digitizing routines were used for the input of spatial and other data, and vector display methods were used for the graphical output. Visual feedback is provided at all stages of the procedures. The interactive computer graphics methods provide many advantages, including convenience, flexibility, the reduction of input errors, and improved communication and response time. (Bell-Graf--Cornell)
W79-08196

IRRIGATION PLANNING 1. CROPPING PATTERN,
California Univ., Davis. Dept. of Land, Air and Water Resources.
G. B. Matanga, and M. A. Marino.
Water Resources Research, Vol. 15, No. 3, p 672-678, June 1979. 5 tab, 22 equ, 10 ref.

Descriptors: *Irrigation efficiency, *Planning, *Cropping pattern, *Linear programming, *Benefit maximization, Programs, Optimization, Land allocation, Prices, Effects, Water supply, Equations, Mathematical models, Systems analysis, Sensitivity analysis.

Irrigation programs, specified in terms of dates and depths of irrigation, are developed for corn, grain, sorghum and pinto beans. The information contained in the irrigation programs for each crop is applied in an area-allocation model is a linear opti-

mization model which maximizes gross margin from yields of crops under consideration subject to total water supply, maximum amount of water that can be delivered for irrigation purposes on any date of irrigation, and irrigation labor. The land area to be allocated to each crop for planting is the decision variable. Results from the area-allocation model include cropping pattern, gross margin, total irrigation depth on each date of irrigation total irrigation labor, and crop yield. Sensitivity analysis is performed to study the effect of changes in crop prices on the optimal results. (See also W79-08202) (Bell-Graf--Cornell)
W79-08201

IRRIGATION PLANNING 2. WATER ALLOCATION FOR LEACHING AND IRRIGATION PURPOSES,
California Univ., Davis. Dept. of Land, Air and Water Resources.
G. B. Matanga, and M. A. Marino.
Water Resources Research, Vol. 15, No. 3, p 679-683, June 1979. 9 tab, 2 equ, 11 ref.

Descriptors: *Irrigation, *Planning, *Water allocation(Policy), *Leaching, *Stochastic processes, *Dynamic programming, Optimization, Simulation analysis, Water policy, Irrigation depths, Interseasonal model, Benefit maximization, Value iteration, Policy iteration, Davis(California), Salinity, Rainfall, Crops, Yield, Measurement, Climatic parameters, Cropping pattern, Mathematical models, Equations, Systems analysis.

For a finite or infinite planning horizon, an interseasonal model is employed to determine an irrigation policy in terms of leaching and seasonal irrigation depths. The interseasonal model employs stochastic dynamic programming and simulation to maximize gross margin over the planning horizon. Solutions to the model are obtained by value iteration and policy iteration methods for finite and infinite planning horizons, respectively, with research crop characteristics and measured climatic parameters from Davis, California. Salinity in the root zone of plants is defined as the state variable. A stage is a year commencing at the end of the rainy season. Seasonal rainfall is treated as a stochastic variable. The information provided by the interseasonal model is used in an area-allocation model that allocates acreage available for planting among the crops for unlimited and limited water supplies. (See also W79-08201) (Bell-Graf--Cornell)
W79-08202

PREFERENCE CRITERION FOR FLOOD CONTROL UNDER UNCERTAINTY,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
R. Krzysztofowicz, and L. Duckstein.
Water Resources Research, Vol. 15, No. 3, p 513-520, June 1979. 4 fig, 4 tab, 2 equ, 30 ref.

Descriptors: *Real-time control, *Reservoir operation, *Multiple purpose, *Flood control, *Conservation control, *Decision making, *Risks, *Game theory, *Disutility model, Hydrology, Tradeoffs, Equations, Reservoir storage, Behavior, Systems analysis.

Real-time reservoir control may be reduced to the dual purpose problem of (1) flood control under uncertain inflow and (2) conservation control (water supply, power generation, low flow augmentation, recreation, etc.) after the flood has receded. Under this circumstance, the reservoir flood control is modeled as a game against nature. The decision maker makes the release decisions based upon his value judgments which express preferences over operating attributes and tradeoffs between reservoir purposes and upon his attitude toward risk. His decision behavior is described by a two-attribute disutility function. It is argued that minimization of expected disutility is a plausible and well-motivated criterion for reservoir flood control under uncertainty. Problems of application are discussed, and an experiment in assessing the disutility functions of individuals is reported. (Bell-Graf--Cornell)
W79-08205

SYSTMES ANALYSIS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. R. Stedinger, and J. M. Bell-Graf.
Journal of the Water Pollution Control Federation, Vol. 51, No. 6, Literature Review, p 1092-1098, June 1979. 61 ref.

Descriptors: *Water resources, *Systems analysis, *Mathematical models, *Analytical techniques, *Optimization, *Simulation analysis, *Management, *Water policy, *Literature reviews, Linear programming, Dynamic programming, Mixed-integer programming, Water quality, Lakes, Marine environment, Storm water, Salinity control, Water treatment, Waste water treatment, Design, Economic efficiency, Cost-benefit analysis, Cost minimization, Data collection, Planning.

Reviewed is a substantive cross section of the literature on systems analysis in water resources policy planning and management whic was published, or which became available to the public, during 1978. The books, articles, and conference proceedings summarized herein all have used analytical and mathematical modeling techniques to reach economically and operationally efficient decisions. Considered are water quality management, lake and marine environments, data collection, multicriterion decision making, wastewater treatment system design, control of treatment systems, stormwater control and management, salinity control, and river recreation management. A wide variety of simulation and optimization methodologies is represented, including the Vollenweider model 'overview modeling,' a dynamic eutrophication model, linear programming, least-squares estimation, mixed-interger programming, surrogate worth tradeoff method, branch and bound algorithm, and hierarchical dynamic programming. Besides the articles outlined, a bibliography containing some 60 references is included. (Bell-Graff--Cornell)
W79-08210

ON THE KROWN METHOD FOR FORECASTING SEASONAL RAINFALL IN ISRAEL,
Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Geography.
L. M. Druyan, and M. Cohen.
Israel Journal of Earth Sciences, Vol. 27, No. 1-2, p 85-87, 1978, 6 fig, 2 ref.

Descriptors: *Experimental models, *Hydrologic models, *Forecasting, *Analytical techniques, Rainfall disposition, Synoptic analysis, Israel, Weather patterns.

This examination of Krown's method (1966) of using certain synoptic characteristics of the October mean 500-mbar chart as predictors of the precipitation anomaly in Israel for the months of November, December and January illustrates that the plausible physical arguments set forth as support do not exclusively verify this technique as a reliable forecast method. October mean 500-mbar charts were examined for the years 1966-1976 and forecasts derived for the winter's precipitation anomaly using Krown's method to indicate that only six of the eleven forecasts agreed with observed data. It is concluded that Krown's method is unreliable and that its former successes were probably due to chance. (Tickes-Arizona)
W79-08364

COMPUTER MODELING OF GROUNDWATER AVAILABILITY IN THE POOTATUCK RIVER VALLEY, NEWTOWN, CONNECTICUT,
Geological Survey, Hartford, CT Water Resources Div.
F. P. Haeni, and Elinor H. Handman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 206, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-77, July 1978. 64 p, 16 fig, 11 tab, 23 ref.

Descriptors: *Groundwater resources, *Model studies, *Groundwater availability, *Water yield, *Water quality, Test wells, Well data, Aquifer characteristics, Surface-groundwater relationships, Groundwater recharge, Groundwater movement, Connecticut, *Pootatuck River valley, *Newton(Conn).

A hydrologic analysis of the stratified drift in Newtown, Conn., based on available data, test drilling, seismic refraction profiling, and the stream-aquifer connection was performed using a digital computer model. Simulated pumping indicates that a total of 4.0 million gallons of water per day (Mgal/d) can be withdrawn from the stream-aquifer system. A minimum of 2.5 Mgal/d is available for future development since Fairfield Hills Hospital is capable of withdrawing 1.5 Mgal/d. Induced recharge from the Pootatuck River supplies 65 percent, or 2.6 Mgal/d of the total pumpage, and captured ground-water outflow supplies the remaining 35 percent of 1.4 Mgal/d. The predicted yields are for long-term average hydrologic conditions; usually dry or extended drought periods would significantly reduce the water available from the aquifer. The quality of surface water in the valley as shown by seven samples from five sites, meets the Connecticut standards for public drinking water except for excessive coliform bacteria. Ground-water quality also meets these standards, as indicated by analyses of 20 samples from 14 wells and 1 spring, but high manganese (up to 15 mg/L) and iron (up to 1.7 mg/L) would require treatment prior to use. Trace metals from one surface-water and four ground-water samples are also within these standards, except for the high cadmium concentration of 26 micrograms per liter in water from one well. (Woodard-USGS)
W79-08393

MAGNITUDE AND FREQUENCY OF FLOODS FOR SMALL WATERSHEDS IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. S. Lowe.
Louisiana Department of Transportation and Development, Office of Highways, Research Study 65-2H, 1979. 52 p, 10 fig, 3 tab, 10 ref, 2 append.

Descriptors: *Floods, *Peak discharge, *Flood frequency, *Flood forecasting, *Regression analysis, Louisiana, Small watersheds, Design flood, Surface runoff, Streamflow, Natural flow, Model studies, Statistical models, Equations, Rainfall-runoff relationships, Flood recurrence interval.

Statewide regression equations are defined for estimating peak discharges with recurrence intervals ranging from 2 to 100 years for streams draining less than 10 square miles (26 square kilometers). Contributing drainage area, main-channel slope, and mean annual precipitation are required for estimating the peak discharges. (Woodard-USGS)
W79-08397

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
For primary bibliographic entry see Field 6E.
W79-08418

COASTAL ZONE MANAGEMENT AND PLANNING IN CALIFORNIA: STRATEGIES FOR BALANCING CONSERVATION AND DEVELOPMENT,
For primary bibliographic entry see Field 6E.
W79-08430

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E
W79-08467

6B. Evaluation Process

RECREATION AND THE OHIO RIVER,
Louisville Univ., KY.
C. A. Leuthart, and H T Spencer
Water Resources Bulletin, Vol. 15, No. 1, p 220-

226, February 1979. 3 fig, 2 tab, 5 ref.

Descriptors: *Recreation, Ohio River, *Boating, *Multiple-use waterways, Mooring facilities, Sampling, Urban centers, Hazards, Data collections, Dams, Locks, Coliforms, Water quality, Economic advantages.

The use of the Ohio River for recreational purposes is increasing. While documentation of the real-time use of the river for recreation is sparse, inferences are made from the availability of mooring facilities. The location of the facilities, the economic advantages of Ohio River recreation, and the hazards to such recreation coincide at the four major urban centers. Future use plans for the Ohio River must consider recreation among the multiple uses of this river. (Bell Graf-Cornell)
W79-08002

ENVIRONMENTAL READINESS DOCUMENT, SMALL SCALE LOW HEAD HYDRO, COMMERCIALIZATION PHASE III PLANNING.
Department of Energy, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE-ERD-0009, Price codes: A03 in paper copy, A01 in microfiche. Report No. DOE/ERD-0009, September 1978. 28 p, 2 fig, 5 tab, 2 append.

Descriptors: *Hydroelectric power, *Turbines, *Environmental effects, *Research and development, Evaluation, Costs, Dams, Dam sites, Impoundments, Technology, Marketing.

The uncertainties concerning small scale low-head hydropower technology which remain to be resolved through research and development are discussed. The characteristics of the technology are examined; status information on the technical and environmental research and development program is provided; the relationship between a considered commercialization schedule and relevant environmental research and development is charted; and environmental concerns significant to the technology are reviewed. There are three major environmental concerns associated with the retrofitting and management of low-head hydropower dam impoundments: (1) impacts on aquatic and semi-aquatic organisms; (2) effects on the downstream environments and organisms of the release of impounded chemicals and silt; and (3) use conflicts. The numerous major uncertainties associated with commercialization of low-head hydropower are represented in a diagram. Availability of sites suitable for either retrofitting old dams or building new dams is the major environmental constraint on the development of low-head hydropower. The likelihood and consequences of adverse findings, problems and uncertainties generated from current or anticipated environmental controls are examined. An assessment is made on the basis of this of the existing or potential barriers to commercialization. All conclusions are probable and based on the uncertainties which were diagrammed. There is only a low probability that an adverse finding will be determined in environmental research and development; probability is medium for technology program delays in the event of an adverse finding; and it is highly probable that energy costs will increase 10% in the event of an adverse finding. (Davison-IPA)
W79-08158

PROCEEDINGS OF A WORKSHOP ON INDEX CONSTRUCTION FOR USE IN HIGH MOUNTAIN WATERSHED MANAGEMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 991, Price codes: A13 in paper copy, A01 in microfiche. Workshop held December 7-8, 1978, Logan, UT. Utah Water Research Laboratory, Utah State University, Logan, General Series UWRL/G-79/01, March 1979. James, L. D. Ed., 289 p, 33 fig, 31 tab, 250 ref, 1 append. OWRT C-80129-P(8407)(1).

Descriptors: *Decision making, *Management, *Land use, *Water resources development, Attitudes, Economics, Methodology, Planning, Forest management, Programs, Social aspects, Political aspects, Mountains, Watersheds.

The compilation of 12 papers from a workshop covers the areas of economic and social impact, ecological issues, and index construction to provide a foundation for continuing research in broadening the base of public participation in decision making in land and water planning. The topics covered include: Forest Service Study Plans; Economic Comparison of Management Options for High Mountain Watersheds; Social Assessment of Land Management Alternatives; An Identification and Evaluation of Strategies for Assessing Social Implications of Alternative Actions on Public Lands; Selection of Variables for Evaluation of Stream Ecosystems in Relationship to Watershed Activities; Stream Habitat and Its Physical Attributes as Influenced by Water and Land Management; General Approaches and Methodology for Construction of Indexes for Natural Resources Planning and Management; Index Utilization in Natural Resources Planning; Political Policy Effectiveness; A Comparison of Three Index Techniques in Use in Forest Service Planning; and Decision Analysis and High Mountain Watershed Planning. (Davison-IPA)
W79-08168

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, EVALUATION APPENDIX.
Army Engineer District, Detroit, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 116, Price codes: A10 in paper copy, A01 in microfiche. 1973. 196 p, 22 tab, 15 fig.

Descriptors: *Michigan, *Waste treatment, *Waste water disposal, *Waste water treatment, *Water quality management(Applied), *Management, *Waste water treatment plants, Waste water(Pollution), Control, Industrial wastes, Municipal wastes, Sewage lagoons, Water pollution treatment, Regional analysis, Economics, Water quality, Aquatic life, Natural resources, Environmental effects, Social impact, Institutions, Land use, Public health, Employment, Planning.

The objective of the SEM study is to propose a regional wastewater management system. The purpose of this appendix is the consideration of factors not considered in engineering design. This evaluation has three objectives; to check the ability of the proposed system to achieve its primary goals; to evaluate the effects the system would have on the surrounding area; and to consider impacts on local, regional and national objectives. This evaluation is broken into several functional areas--ecologic, hygienic, economics, agricultural economics, social and aesthetic. An early evaluation of system components is made, including wastewater treatment methods, storm handling methods, and stormwater management. Preliminary alternatives are then formulated including investigations into advanced wastewater treatments, independent physical-chemical treatments, land irrigation treatments and combination treatments. These preliminary alternatives are evaluated in terms of water quality, aquatic life and waterfowl, public health, energy and natural resources, employment, land and water use changes, land values, area economy and institutions, socio-economics and system costs. A revised concept for land irrigation treatment is presented and evaluated. Lastly three final alternatives are selected, one emphasizing regional wastewater treatment plants, one including both regional plants and land irrigation, and one calling for the major portion of the region's wastewater to be treated in the plant system common to all plans, but with land irrigation for treating both municipal-industrial wastewater and stormwater in two specific areas. Each alternative is evaluated. No final recommendation is made. (Zayac-NC)
W79-08171

SOUTHEASTERN MICHIGAN (SEM) WASTEWATER MANAGEMENT SURVEY SCOPE STUDY, COMMENTS APPENDIX,
Army Engineer District, Detroit, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 114, Price codes: A06 in paper copy, A01 in microfiche. 1974. 96 p.

Descriptors: *Waste water treatment, *Water quality management, *Michigan, *Evaluation, *Public meetings, *Public participation, *Public comment, Public access, Institutions, Reviews, Management, Planning, Regional analysis, Waste water disposal, Agencies.

The objective of the SEM study is to propose a regional wastewater treatment system. The purpose of this appendix is to present the views expressed by government agencies and interested citizen groups and individuals, based on their review of the draft report and the response of the Detroit District to their comments. The comments received were varied; concerns centered around system costs and source of funds to operate such systems, use of rich agricultural land for waste treatment, and allocation of energy resources to wastewater treatment. A cursory summary of comments received and responses is presented, followed by two attachments. The first attachment contains comments by interested agencies. The second attachment contains statements presented at the Public Meetings held on 11, 12 and 13 December 1973. (Zayac-NC)
W79-08172

PROCEEDINGS OF A SEMINAR ON NON-STRUCTURAL FLOOD PLAIN MANAGEMENT MEASURES,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 2E.
W79-08173

A STUDY OF WATER QUALITY ALTERNATIVES FOR THE CITY OF LAKE CHARLES, LOUISIANA,
Lake Charles-McNeese Urban Observatory, LA.
W. E. Hohnstein, and G. Hicks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 731, Price codes: A04 in paper copy, A01 in microfiche. Report No. UO-LCCM-LAC-77-016, December 1977. 58 p, 13 tab. H-2196R.

Descriptors: *Water supply, *Water management, *Water rates, *Water levels, *Lake Charles(LA), Water storage, Economics, Income, Utilities, Financing, Government finance, Marginal costs, Water demand, Water costs, Capital costs, Louisiana, Price index.

The origin and present condition of the Greater Lake Charles Water Company are detailed in this report. The Company has served the City of Lake Charles as the only public supplier of water since 1956. In 1990 the Company will become property of the City of Lake Charles when its original bond is liquidated. The authors describe the creation of the Company as a non-profit organization with ties to the city government but isolated from its political atmosphere. The documents creating the Company, governing its financial operations, and outlining its organizational structure are presented with an analysis of present relations between the Compay and the City Council. The authors investigate the possibility of improving and raising the reliability of water service in Lake Charles by changing the ways the Company relates to city government. The importance of water rates is examined because regardless of the nature of the Company charter, these rates will be fixed by Administrative decision and not determined in a free market. The authors discuss the economics of water production and pricing. Rates in other cities, marginal cost concepts, rate structure and demand, and cost concepts are some of the topics discussed. A number of general conclusions are presented. (Coan-NC)
W79-08176

ESTABLISHMENT OF OPERATIONAL GUIDELINES FOR TEXAS COASTAL ZONE MANAGEMENT: WATER NEEDS AND RESIDUALS MANAGEMENT,
Texas Univ., at Austin. Div. of Natural Resources and Environment.
J. S. Sherman, and J. F. Malina, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 156,

Price codes: A09 in paper copy, A01 in microfiche. Report No. NSF-RA-E-74-090, 1974. 176 p. GI34870X.

Descriptors: *Water utilization, *Water resources, *Coasts, *Water quality, *Water treatment, *Texas, *Corpus Christi Bay Area(TX), *Coastal Zone Management, Water demand, Water management(Applied), Regional planning, Land use, Economics, Wastewater, Air pollution, Urban runoff, Solid wastes.

271 objective of the Texas Coastal Zone Management Project is the development and evaluation of a methodology for effective management of the Texas Coastal Zone. This methodology will include the quantitative and qualitative assessment of water requirements and residuals generation to determine the future water requirements and residual loads resulting from predicted levels of economic activity and population resulting from three hypothetical coastal zone management policies. The area for which the methodology was tested was the 13 county Coastal Bend Council of Governments region with particular emphasis on the Corpus Christi Bay Area. Data were collected for: (1) water use patterns of municipal, industrial, and agricultural consumers; (2) wastewater flows from municipal wastewater treatment plants, industrial return flows and storm runoffs; (3) solid waste generation from municipalities and industries; and (4) air emissions from automobiles and industries. Mathematical models are presented to predict rainfall-runoff relationships, water quality, wastewater treatment costs, and industrial water use as a function of employment. Appendices contain information on standard industrial classifications, industrial water use and solid waste generation. Conclusions are offered concerning the availability of fresh water supplies, the wastewater and solid waste disposal situation, and the air pollution potential of the area. (Coan-NC)
W79-08180

WATER NEEDS AND RESOURCES. RATIONAL MANAGEMENT: THE KEY TO THE SUPPLY-DEMAND EQUATION,
United Nations Educational, Scientific and Cultural Organization, Paris (France). Natural Resources and Environmental Sciences.
For primary bibliographic entry see Field 6E.
W79-08182

ECONOMIC IMPACTS OF ADMINISTRATIVE WATER LAW SYSTEMS,
Florida Univ., Gainesville. Dept. of Food and Resource Economics.
C. Kiker, and G. D. Lynne.
Transactions of the ASAE, Vol. 22, No. 1, p 115-121, Jan.-Feb. 1979. 19 equ, 20 ref.

Descriptors: *Economic impact, *Economic efficiency, *Water law, *Water allocation(Policy), *Florida, *Water rights, *Administrative regulation, Eastern U.S., Equations, Systems analysis, Production model, Prices, Marketing, Common law doctrines, State level, Private uses.

A move to administrative regulation of water is taking place in the eastern states. Private entitlements to water are being allocated on technically-based criteria which ignore economic efficiency. Wasteful water use can result. Allocation procedures utilizing economic criteria can increase net benefits from water use. Several allocation alternatives including a technical approach, the western appropriation doctrine, a limited economic information approach, and a pseudo-market are examined. Discussed is water law in the eastern states. Described is a conceptual model serving to clarify the issues under consideration; the production model allows comparison of the suggested alternatives for water allocation. Emphasized are economic efficiency impacts, but economic distribution is also an important consideration in water management. (Bell-Graf--Cornell)
W79-08200

A MODEL TO GENERATE RENT SURFACES: APPLICATIONS AND RESULTS FOR A PUBLIC PROJECT,
John F. Kennedy School of Government, Cambridge, MA.
P. F. Ricci, E. R. Glaser, and R. E. Laessig.
Water Resources Research, Vol. 15, No. 3, p 539-545, June 1979. 5 fig, 1 tab, 7 equ, 19 ref.

Descriptors: *Rent surfaces, *Public investment, *Fourier series expansion, *Distance, Projects, Parks, *Lakes, Land values, Reservoirs, Economic impact, Estimating, Equations, Statistical methods, Project activities, Gravity modeling, Mathematical models, Systems analysis.

Suggested is an alternative approach to modeling rents generated by a public investment. The formulation adopted adds direction, through a Fourier series expansion, to distance--the independent variable of potential models. The coefficients of the enhanced model are estimated statistically and the resulting equations utilized to generate rent equipotentials. The proposed formulation enables the representation of the various influences that intervene to disturb the otherwise smooth rent surfaces normally obtained from a potential model. The economic impact of a newly developed park-lake complex is studied to provide an application of the methodology developed. Land values from deed records, the dependent variable of the model, are regressed against distance and direction from the centroid of the park-lake complex. The findings show that rent surfaces change in configuration as different project-related activities take place. For example, construction of the reservoir increases land values nearby the park-lake, while the lack of visible activities does not affect land values. (Bell-Graf--Cornell)
W79-08203

WATER TRADE-OFF BETWEEN ELECTRIC ENERGY AND AGRICULTURE IN THE FOUR CORNERS AREA,
New Mexico Univ., Albuquerque. Dept. of Economics.
M. Gisser, R. R. Lansford, W. D. Gorman, B. J. Creel, and M. Evans.
Water Resources Research, Vol. 15, No. 3, p 529-538, June 1979. 1 fig, 10 tab, 17 ref.

Descriptors: *Electric energy, *Agriculture, *Estimating, *Economic impact, *Linear programming, *Benefit maximization, *Irrigation, Navajo Indian regions, Projects, Farms, Demand, Shadow prices, Constraints, Optimization, Employment, Water allocation(Policy), Mathematical models, Systems analysis.

The results of estimating the economic impact of the growing electric generating sector on agriculture are given. A linear programming (LP) model was designed to represent agriculture in three subregions and the Navajo Indian Irrigation Project. The assumption was made that the electric generating sector will purchase water from farmers. The impact of shifting water from agriculture to the electric generating sector was evaluated by reducing the water allocation for agriculture at discrete steps, and after each reduction the LP model was run. Changes in the shadow prices of water, farm income, and employment were calculated after each linear programming run. Regional multipliers (at the county level) were applied to gauge the impact on the regional economy. The model maximized net revenue. It was concluded that commercial farms would be able to sell water to the energy sector by switching from flood irrigation to sprinklers. Part-time farmers would reduce their cultivated acreage. Farmers would need relatively large funds to invest in sprinklers. For the utilities, the cost of the water would be relatively insignificant. (Bell-Graf--Cornell)
W79-08204

MULTI-GOAL ANALYSIS OF A SHORT-RUN RESERVOIR OPERATION,
Milan Univ. (Italy). Inst. di Elettrotecnica ed Elettronica and Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
For primary bibliographic entry see Field 4A.
W79-08206

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, VOLUME 1, PART I -- IV,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. H. Marks, E. Johnson, D. Wood, P. Deese, and M. Baram.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 491, Price codes: A19 in paper copy, A01 in microfiche. Research Report NO. R77-19, June 1977. 434 p, 65 fig, 12 tab, 191 ref, 4 append. OWRT-C-5241(No. 4236) (1), 14-31-0001-4236.

Descriptors: *Model studies, *Water resources development, *Planning, *Land use, Mathematical models, Computer, Programs, Methodology, Legal aspects, Social aspects, Political aspects, Institutions, Economics, Southern New England Water and Related Land Resources Study.

The economic, social, institutional and physical relationships associated with developing, using, implementing, adjusting, and supporting useful and useable planning-oriented water and land use models are examined and discussed. This two-year study, sponsored in part by the Office of Water Research and Technology, focused on the 'Southeastern New England Water and Related Land Resources Study' (SENE Study) to develop tools and recommendations which may be applied to similar water and related land use planning efforts. Part I of Volume I presents a description of the SENE planning methodology, explains the role of a screening model in planning, and provides the mathematical formulation for such a model. In Part II the inherent difficulties associated with traditional control approaches are discussed, and an innovative 'performance control' approach is presented in which its legal, political, technical and institutional aspects are surveyed; application criteria are suggested. A linear systems model to predict the hydrologic consequences of land use development is developed in Part III, and a user's manual for the screening model is provided in Part IV. (See W79-08272 and W79-08273) (Davison-IPA)
W79-08271

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART V: PERSPECTIVES AND TOOLS FOR COPING WITH SOCIOTECHNICAL ENGINEERING SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
S. A. West, and J. C. Spencer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 492, Price codes: A08 in paper copy, A01 in microfiche. Research Report No. R77-20, December 1977. 159 p, 8 fig, 6 tab, 55 ref. Volume 2 of 3. OWRT-C-5241(No. 4236) (1), 14-31-0001-4236.

Descriptors: *Planning, *Social participation, *Water resources development, *Land use, *Social aspects, Systems analysis, Computer models, Management, Methodology, Regional development, Engineering, Southeastern New England Water and Related Land Resources Study.

The role of the planner in water resources development and related land use is changing from one where planning is conducted in an objective and scientific manner to one where planning is facilitated by soliciting public involvement. Two of the basic limitations of systems analysis which limit its use for planning human societies are: (1) the systems are of little use in formulating a precise, operational problem statement, and (2) the system methods do not aid human judgment. A discussion on human judgment includes recent developments such as the use of computer tools to aid learning and enable users to have new insights. Engineering problems necessitating the exercise of judgment are the inherebtly sociotechnical problems transcending the technical demands of purely physical systems, and problems dealing with physical systems for which no single solution is possible. The disadvantages of systems analysis related to the preparation and use of social indicators are examined. Six judgment heuristics are set forth and

discussed. A retrospective view of how the 'Southeastern New England Water and Related Land Resources Study' (SENE Study) might have been conducted had it been guided by this study. (See also W79-08271) (Davison-IPA)
W79-08272

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART VI: LAND USE CAPABILITY MAPPING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
K. Twyford, and G. B. Baecher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 493, Price codes: A07 in paper copy, A01 in microfiche. Research Report No. R78-17, June 1978. 131 p, 43 fig, 4 tab, 52 ref, 5 append. Vol. 3 of 3. OWRT C-5241-(No. 4236) (1), 14-31-0001-4236.

Descriptors: *Mapping, *Land use, Land resources, Capability mapping, Land management, Maps, Evaluation, Measurement, Spatial distribution, Computer programs, Computer models.

The need for more well founded methodologies for landscape resource evaluation, or 'capability mapping' are examined. Capability mapping can be applied to a large set of problems besides land-use planning. Examples of problems involving spatially defined objective functions include waste disposal siting, mineral exploration, and economic location analysis among many others. Simple modifications of existing techniques or combinations of techniques and use of evaluation theory directly to develop a new methodology are considered. Current mapping schemes ranging from hand drawn overlays to computer weighting programs are summarized. Fundamentals of measurement theory bearing on capability mapping are reviewed, and deficiencies in present techniques are discussed. The concepts of value and utility functions are presented, and a mapping scheme based on these concepts is developed. Previous uses of computers to generate and evaluate capability maps are summarized, and the value/utility theory program developed in the course of this work is presented. (See also W79-08271) (Schaefer-IPA)
W79-08273

PUBLIC AND PRIVATE IMPACTS OF ALTERNATIVE FLOOD ASSISTANCE, INSURANCE, AND RECOVERY EFFORTS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
R. N. Boisvert, and M. J. Rettger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 362, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report. Center for Environmental Research, Cornell University, Ithaca, New York, May 1979. 12 p, 3 tab, 4 equ, 9 ref. OWRT A-074-NY (2), 14-34-0001-7068.

Descriptors: *Water resources, *Simulation analysis, *Flood insurance *Disaster loans, *Economic impact, Mathematical models, Systems analysis, Equations, Programs, Costs, Benefits, Evaluation, Sensitivity, Binghamton(NY).

Alternative federal flood disaster assistance programs are evaluated through an economic comparison of flood insurance and disaster loan programs. The distribution of costs, benefits, and program transfers, both private and public, are simulated over time and are analyzed to determine the sensitivity of program performance to specific program parameters. Empirical results for the Binghamton, New York area demonstrate that both programs provide adequate levels of protection at approximately equivalent costs. Variations in premium and interest rate subsidies have major effects on the distribution of total costs between the public and private sectors.
W79-08274

ANALYSIS OF UNCERTAINTY IN FLOOD PLAIN MAPPING,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-08340

ALTERNATIVE FUTURES PLANNING,
SYNERGY Consultation Services, Saratoga, CA.
J. L. Creighton.
Report prepared for Bureau of Reclamation, Denver, Colorado, August 1976. 269 p, 44 fig, 4 append.

Descriptors: *Planning, *Future planning(Projected), *Alternative planning, Water utilization, Water resources development, Water resources, Management, Alternative water use, Administration, Methodology, Projections, Social aspects, Costs, Lake County(California), Napa County(California), Yolo County(California), Solano County(California).

Procedures were developed which involve the public in projecting alternative futures in water needs planning. These planning procedures were applied as a study of the total water needs of Lake, Napa, Yolo, and Solano Counties in California. A method of evaluating alternatives is provided which attempts to protect, rather than foreclose, the options represented by the alternative futures. The major steps in the study were: (1) developing scenarios, (2) identifying water demands, (3) developing alternative plans, (4) cross-impacting the plans, (5) developing an operating plan, and (6) developing a decisionmaker's guide. A work plan was also developed which estimated time and costs for the study based on normal planning procedures to establish a standard for comparing costs and time in utilizing the alternative futures planning procedures. It is concluded that the procedures developed provide visibility to the assumptions made in the study so that the necessary corrections needed can be made to make the outcome of the study a continuing decision making process instead of a one-time product. (Davison-IPA)
W79-08352

PRELIMINARY OBSERVATIONS ON THE PROSPECTS OF REARING TROUT IN CAGES IN RHODESIAN IMPOUNDMENTS,
Department of National Parks and Wild Life Management, Inyanga Trout Research Centre, Inyanga (Rhodesia).
A. R. Macgown.
Rhodesia Science News, Vol. 10, No. 6, p 157-158, June 1976. 3 fig.

Descriptors: *Trout, *Rainbow trout, *Impoundments, *Fish farming, Fish management, Agriculture, Fish, Cold-water fish, Reservoir fisheries, Design, Rhodesia.

There have been few attempts at culturing trout in cages in standing fresh waters. Because there is not, in this type of situation a substantial, continuous and infallible flow of fresh water to carry off waste products and bring in fresh and adequately oxygenated water, metabolite disposal or dispersal takes place through the mesh of the cage and dissolved oxygen enters by the same route. A small sized cage of shallow depth made of woven black steel mesh met the requirements for space, visibility, availability, and durability. A square wooden frame around the cage gave it rigidity; floats were of expanded polystyrene or fuel drums. Experiments were conducted using cages with volumes of 1.17 and 2.63 cubic meters. The cages were anchored at a total depth of 3 meters in the Mare Dam, Inyanga National Park. Nine month old rainbow trout were used as stock. Fish were fed trout pellets twice daily. After four months fish density had increased about 50%. Mortality during the first six months was less than 1%. The trial showed that rainbow trout can be successfully and economically reared under such conditions. Further trials are in progress to determine criteria for smaller fish, maximum cage concentrations, and spacing distance for cages. (Schaefer-IPA)
W79-08360

THE CLEAN WATER ACT OF 1977: GREAT EXPECTATIONS UNREALIZED,
For primary bibliographic entry see Field 6E.
W79-08420

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX C--ECONOMIC BASE,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 748, Price codes: A13 in paper copy, A01 in microfiche. Chaired by the U.S. Corps of Engineers, 1969, 242 p, 11 addenda, 87 tab, 18 fig, 7 maps, 34 photos.

Descriptors: *Planning, *Economics, *Industries, *River basin development, *Water resources, *Land resources, *Willamette River(OR), Oregon, Economic impact, Employment, Income distribution, Industrial production, Regional economies, Social impacts, Economic efficiency, Optimum development plans, Income analysis, Employment, Chemical industry, Agriculture, Lumbering, Food processing, Electric power industry, Food processing industry, Pulp and paper industry, Governments, Regional analysis, River basins, Manufacturing, Population.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette Basin in Oregon. Appendix C, along with Appendices A and B, provides supporting data for the functional Appendices D through L. It contains economic data intended to aid in the determination of the scale, sequence, and timing of water and related land resources development. A method of analysis is outlined early in the study including a description of the nature and pattern of economic change and projection techniques. Present economic status is described in terms of population, personal income and employment; in these descriptions, data are presented by region, basin, and subbasin. Industry studies are undertaken. The agricultural economy is discussed in terms of its characteristics, land resources, and projections. Food processing, forest products industries, mining and mineral industries, primary metals (including silicon, ferroalloys, aluminum, and steel), and the chemical products industry are all reviewed in detail. The final section presents projections by employment in the basic industries--agriculture, mining, manufacturing, government--and residentiary industries. Projections of population and personal income estimates are also included. (See also W79-08433) (Zayac-NC)
W79-08436

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX J--POWER.
Pacific Northwest River Basin Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 762, Price codes: A06 in paper copy, A01 in microfiche. Chaired by Bonneville Power Administration, 1969, 74 p, 14 tab, 9 fig, 7 maps, 15 photos, glossary.

Descriptors: *Hydroelectric plants, *Power marketing, *Electric power, *Electric power production, *Power line carriers, *Power plants, *River basin development, Oregon, Power head, Reservoirs, Economics, Electric power costs, Electric power demand, Electric power industry, Power operation and maintenance, Operating costs, Maintenance costs, Power system operation, Electric power failure, Proprietary power, Transmission lines, Hydroelectric plants, Nuclear power plants, Thermal power plants, Pumped storage, Reservoir operation, Pump turbines, River basins, Peak power, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix J - one of the functional appendices - is based on data contained in the three supporting appendices, A through C. Present power needs are outlined by looking at power requirements, load characteristics, power sources, power transmission, and

special problems. Electric power requirements are assessed in a discussion of future demand. Short-term (immediate) projections are made for domestic, irrigation, commercial, and industrial needs. Long-term projections are made to the year 2020. Alternatives for both power resources and transmission facilities are studied. Among the power resources reviewed are 'conventional' hydroelectric plants, pumped-storage plants, fossil-fueled plants, and nuclear-fueled plants. The study of transmission facilities includes an assessment of land requirements, research and development, and the effects of thermal plant location. The findings indicate that the Basin's future power demands will most likely be met by increased imports from outside the Basin, from nuclear power plants to supply around-the-clock base loads, and from pumped-storage to supply peaking. The Basin has no significant fossil fuel supply; development of this type of generation would therefore require importation of these fuels. Since transportation costs are quite high, fossil-fueled plant construction is inhibited. Finally, the potential for large-scale conventional hydro-power is limited, although small conventional plants may be developed to supplement both base and peak load power supplies. (See also W79-08433) (Zayac-NC)
W79-08443

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX K--RECREATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 763, Price codes: A14 in paper copy, A01 in microfiche. Chaired by the U.S. Bureau of Outdoor Recreation, 1969, 174 p, 37 tab, 12 maps, 90 photos.

Descriptors: *Recreation, *Recreation demand, *Planning, *River basin development, *Outdoor recreation, *Water resources development, Oregon, Economics, Social needs, Social participation, Water demand, Recreation facilities, Recreation wastes, Water pollution sources, Aesthetics, Environmental effects, Attitudes, Reservoirs, Public health, Water policy, Silting, Non-structural alterntives, Natural resources, Archaeology River basins, Boating, *Willamette River(OR).

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in oregon. The purpose of Appendix K is to assess recreation in the study area with respect to the present and future effects on the land, water, and overall economy of the area. This functional appendix relies on data contained in the three supporting Appendices, A through C. The present status of recreation resources is reviewed by looking at accessibility, recreation use, economic impacts of outdoor recreation, and preservation of irreplaceable values. Problems including conflicting demands, reservoirs vs. free-flowing streams, contamination, overuse and missuse, silting. and recreation supply are outlined as a lead-in individual subbasin analyses for the 11 subbasins in the area. Future demand is estimated by studying demand variables and assessing recreational needs. These needs are then allocated by subbasin. Lastly, alternative means to satisfy demand are discussed. Considerations such as water storage, private vs. public development, municipal recreation, land use, and land acquisition are assayed. Institutional responsibility is deliberated. Recommendations such as water storage, private vs. public development, municipal recreation, land use, and land aquisition are are assayed. Institutional responsibiliyt is deliberated. Recommendations include emphasizing land use controls and non-structural measures to facilitate recreation development; estalishing an interagency task force to monitor development; acdelerating public information and education programs; and initiating a study to identify and protect irreplaceable resources of natural, archaeological, and historical interest. (See also W79-08433) (Zayac-NC)
W79-08444

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

WATER POLLUTION CONTROL (ASSESSING THE IMPACTS AND COSTS OF ENVIRONMENTAL STANDARDS),
For primary bibliographic entry see Field 6E.
W79-08468

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST SHARING AND IMPLEMENTATION OF NATIONAL WATER RESOURCES POLICY,
Georgia Univ., Athens. Inst. of Natural Resources.
J. Sellers, and R. M. North.
Water Resources Bulletin, Vol. 15, No. 1, p 189-197, February 1979. 3 tab, 14 ref.

Descriptors: *Water resources, *National policy, *Cost sharing, Economic development, Managerial approach, Multiple objectives, Environmental quality, Conservation.

In this article a managerial approach to developing and implementing National Water Resources policy is suggested. Proper consideration can be given to national economic development (NED), environmental quality (EQ), and conservation and still result in an implementable policy at the operational level if proper incentives are built into the process with proper attention given to alternate non-Federal cost sharing rates. Not only can these multiple objectives be entertained, but the Administration and Congress will have a management tool that should ensure a certain probability of success. (Bell Graf-Cornell)
W79-08011

OPTIMAL PRICING AND REGULATION OF ELECTRIC ENERGY IN A SYSTEM DEPENDING ON HYDROELECTRIC CAPACITY,
Idaho Univ., Moscow. Dept. of Economics.
R. A. Lyman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 013, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Idaho University, Research Technical Completion Report, May 1979. 62 p, 7 fig, 15 tab, 30 ref, 1 append. OWRT A-059-IDA(1). 14-34-0001-8014.

Descriptors: *Electric power, *Electric power demand, *Peak power, *Electric power rates, Peak loads, Power marketing, Reservoir operation, Electric power costs, Rates, Hydroelectric power, Idaho.

The benefits and costs of alternative regulatory policies in pricing electric power are evaluated on normative grounds. The effects of these policies on seasonal electric loads, hydroelectric generation, and seasonal reservoir fluctuation are analyzed with respect to residential, commercial, and industrial customer classifications in the North Idaho Service Area of the Washington Water Power Company. Results of this study establish the benefits of seasonal, peak-load pricing in Northern Idaho. Although time-of-day pricing may not be desirable for residential and commercial customers, industrial customers would benefit. The optimal pricing strategy is one with a two-part schedule pricing scheme which includes a 'usage' price for power set at marginal cost in each pricing period and a dividend program for equity adjustment between stockholder and customer. It is concluded that even though a conservative approach should be used in interpreting the results, important effects can be expected in terms of seasonal operation of certain reservoirs. (Davison-IPA)
W79-08165

RELATIVE VALUE OF WATER AND LAND OUTDOOR RECREATION ACTIVITY AREAS,
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
J. E. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 996, Price codes: A05 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Idaho University, Research Technical Completion Report, April 1979. 75 p, 8 fig, 16 tab, 10 ref, 5 append. OWRT A-055-IDA (1), 14-34-0001-7027 & 7028.

Descriptors: *Recreation, *Recreation facilities, *Parks, *Management, *Cost allocation, *Social participation, Planning, Fishing, Boating, Swimming, Camping, Economic impact, Social aspects, Attitudes, Water utilization.

In implementing a methodology to ascertain the cost effectiveness of each activity area at the Heyburn State Park, Idaho, the relative value of each activity was measured by the paid comparison method, and the preference-cost ratio or efficiency index for selected activities was determined by comparing the relative value of the activity with the management cost of providing the area for the activity. The four sets of activities measured were: (1) fishing, boating, swimming, hiking, camping, and picnicking; (2) dock fishing, boat fishing, and shore fishing; (3) water skiing, motorboat fishing, and motorboating; and (4) canoeing, sailboating, and motorboating. The relative values provide a measure of distance between activities of a set along a preference scale, and preference-cost ratios identify where unequal resource allocations are occurring. In terms of preference/cost ratios hiking, boating, and fishing were the most efficient activities; the least efficient were swimming, picnicking, and camping. Although allocating more management money may lead to a more equitable distribution of funds based on preference/cost ratios, it may or may not change the preference scale value for an activity (Davison-IPA)
W79-08166

A STUDY OF WATER QUALITY ALTERNATIVES FOR THE CITY OF LAKE CHARLES, LOUISIANA,
Lake Charles-McNeese Urban Observatory, LA.
For primary bibliographic entry see Field 6B.
W79-08176

FINANCIAL RESPONSIBILITY FOR WATER POLLUTION-OUTER CONTINENTAL SHELF (FINAL RULE).
Federal Maritime Commission, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08409

OFFSHORE OIL POLLUTION COMPENSATION FUND AND CLAIMS PROCEDURES (FINAL RULES).
Coast Guard, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08410

THE CHANGING WATER MARKET FOR ENERGY PRODUCTION,
McGeorge School of Law, Sacramento, CA.
For primary bibliographic entry see Field 6E.
W79-08432

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

6D. Water Demand

DISTRIBUTIVE POLITICS RECONSIDERED--THE WISDOM OF THE WESTERN WATER ETHIC IN THE CONTEMPORARY ENERGY CONTEXT,
Arizona Univ., Tucson. Dept. of Political Science.
For primary bibliographic entry see Field 6E.
W79-08162

ESTABLISHMENT OF OPERATIONAL GUIDELINES FOR TEXAS COASTAL ZONE

MANAGEMENT; WATER NEEDS AND RESIDUALS MANAGEMENT,
Texas Univ., at Austin. Div. of Natural Resources and Environment.
For primary bibliographic entry see Field 6B.
W79-08180

RESERVED WATER RIGHTS FOR FEDERAL AND INDIAN RESERVATIONS: A GROWING CONTROVERSY IN NEED OF RESOLUTION.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-08185

AVAILABILITY OF ADDITIONAL GROUNDWATER SUPPLIES IN THE PASCAGOULA AREA, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-08387

GOVERNORS SEEK A WATER POLICY THAT HAS SOMETHING FOR EVERYONE,
For primary bibliographic entry see Field 6E.
W79-08427

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX F -- IRRIGATION.
Pacific Nothwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08439

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX H--MUNICIPAL AND INDUSTRIAL WATER SUPPLY.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 3B.
W79-08441

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX 1--NAVIGATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 761, Price codes: A05 in paper copy, A01 in microfiche. Chaired by U.S. Army Corps of Engineers, 75 p, 10 tab, 6 fig, 2 maps, 19 photos, 3 addenda. 1969.

Descriptors: *Navigation, *Navigable waters, *Navigable rivers, *Transportation, *River basin development, *Waterborne commerce, *Water resources development, Oregon, Harbors, Locks, Economics, Bank stabilization, Channel improvement, Planning, Inland waterways, Equipment, River basins, *Willamette River(OR), Bulk commodities.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix 1- one of the functional appendices - relies upon supporting data contained in the 3 supporting appendices, A through C. The present status of navigation in the Basin is studied through existing projects (including deep-draft channels, inland waterways, hazards, traffic, and bridge and utility crossings), commercial and noncommercial facilities, other transportation modes and their impacts upon navigation, and existing problems. Future demand is estimated for both Portland Harbor and inland waterways. Here potential waterborne commerce, commercial facilities, noncommercial use, equipment, and economics are assessed. Lastly, alternative means to satisfy navigation demands are reviewed for each of the three reaches of the Willamette. The report concludes that there is sufficient volume of commerce in bulk commodities that are well adapted to water transport to warrant improvement of the river for navigation. The improvement project considered most worthy would provide for replacement of Willamette Falls Locks with a larger, single-lift facility, and improvement of the channel between Oregon City and Albany. An analysis of the comprehensive plan for water resources with regard to navigation is contained in Appendix M - Plan Formulation. (See also W79-08433) (Zayac-NC)
W79-08442

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX J--POWER.
Pacific Northwest River Basin Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6B.
W79-08443

6E. Water Law and Institutions

ALTERNATIVES FOR GROUND WATER LAW CHANGE IN ARIZONA,
R. B. Fleming, and K. E. Foster.
Water Resources Bulletin, Vol. 15, No. 1, p 198-205, February 1979. 30 ref.

Descriptors: *Groundwater, *Arizona, *Water law, *Alternatives for change, *Water level decline, Legislation, Water rights, Wells, Water Supply, Colorado River, Droughts, Overdraft, Western US, Prior appropriation doctrine, Water resources, Legislative history, Reasonable use.

Western state water resources are drawing increasing attention because of prolonged drought, groundwater overdraft and an ever-increasing awareness of insufficient Colorado River water to supply a growing population and meet industrial demand. Arizona is no exception, and the alarming decline in groundwater levels has prompted the Arizona State Legislature to adopt legislation establishing the Ground-Water Management Study Commission to recommend legislative action by 1979. This paper summarizes Arizona's ground water legislative history and discusses possible alternatives for change. The authors address specific issues facing the state and offer a set of possible Commission recommendations. (Bell Graf-Cornell)
W79-08003

MONTANA'S EXPERIENCE IN RESERVING YELLOWSTONE RIVER WATER FOR INSTREAM BENEFICIAL USES--LEGAL FRAMEWORK,
Bureau of Reclamation, Denver, CO. Water Quality Office.
J. L. Thomas, and D. Klarich.
Water Resources Bulletin, Vol. 15, No. 1, p 60-74, February 1979. 3 tab, 14 ref.

Descriptors: *Montana, *Water law, *Yellowstone River, *Instream use, *Flow reservation applications, Administrative procedures, Irrigation, Standards, Water quality, Dissolved solids, Water Use Act, Water Moratorium Act, Instream requests, Fish and wildlife requirements, Consumptive use requests, Municipalities, Multipurpose requests, Industrial applications, Water-use conflicts, Public hearing, Water depletion.

The Yellowstone River historically has produced an ample supply of high quality water which is widely used for irrigation, municipal and industrial purposes, recreation, and fish and wildlife. Recently, energy companies have attempted to obtain water rights in the Yellowstone basin for energy companies have attempted to obtain water rights in the Yellowstone basin for energy conversion facilities in coal-rich southeastern Montana. Existing users fear that energy diversions will impair their rights, preclude expansion of present beneficial users, degrade water quality, and adversely affect fish and aquatic life. In response to these concerns, the Montana Legislature enacted several laws to regulate water appropriations in the Yellowstone River basin, including means by which state and federal agencies could apply for reservations of water for future beneficial uses. Thereafter, both the Montana Fish and Game Commission and the State Water Quality Bureau formally requested relatively large instream flows to protect fish and wildlife and to maintain water quality. This paper describes Montana's experience through December 1977 with the administration of water in the Yellowstone basin under these laws; emphasis is placed on the major requests for instream flows. (Bell Graf-Cornell)
W79-08007

SOIL SATURATION PROBLEMS ON THE TRUCKEE-CARSON PROJECT, NEVADA,
Nevada State Historical Society, Reno.
J. M. Townley.
Agricultural History, Vol. 52, No. 2, p 280-291, April 1978, 37 ref.

Descriptors: *Drainage programs, *History, *Water policy, *Political constraints, *Institutional constraints, *Land reclamation, Administration, Drainage effects, Drainage engineering, Drainage systems, Governmental interrelations, Water resources development, Irrigation water, Nevada, Seepage, Saturated soils.

One of the 5 original irrigation projects proposed by the Reclamation Service in 1903, the Truckee-Carson Project, in Churchill County, Nevada, is described here to illustrate at project level the problems during the progressive era of merging engineering specialists into bureaucratic form. The importance of proper drainage is a lesson which was well learned by the dirt farmer during the expansion of irrigated farmland in the western states and territories in the latter half of the nineteenth century. It is this question of drainage that is examined in this historical account of two decades of interactions between the Department of Interior and the Truckee-Carson Project to document that decisions supposedly made from sound engineering tabulations were, in reality, based upon political necessity. The drainage system constructed between 1904 when the ground studies were conducted and 1906 when the project first provided irrigation water represented a poor compromise between conscientious groundwater specialists and economy-minded USRS officials. Although the unproductive disputes documented here that ensued over the next two decades ended in 1928 with the completion of a barely adequate drainage system, continuing distrust appears to be a heritage of this earlier time. From actions taken by the Reclamation Service during this 20-year period, it is implied that the technician changes more than the system within which he functions. (Tickes-Arizona)
W79-08022

DISTRIBUTIVE POLITICS RECONSIDERED--THE WISDOM OF THE WESTERN WATER ETHIC IN THE CONTEMPORARY ENERGY CONTEXT,
Arizona Univ., Tucson. Dept. of Political Science.
H. Ingram, and J. R. McCain.
In: New Dimensions to Energy Policy, p 69-77, (1978). Lexington Books, D. C. Heath and Company, Lexington, MA; Toronto. Lawrence, R. Ed., 2 tab. OWRT A-085-ARIZ(1).

Descriptors: *Water policy, *Competing uses, *Water utilization, *Water allocation(Policy), *Institutional constraints, *Water resources development, Planning, Economics, Political aspects, Local governments, Regions, Federal government, Water rights, Energy.

The potential effect of energy development demand for water on the prevailing patterns of water use in the Colorado River Basin is examined with respect to policy-making. If the rich energy resources of the Colorado Basin were to be developed to meet the Nation's demand, 28 to 52% of the available surface water in the upper basin will have to be used. This consumption would result in greater salinity in the Colorado River and decrease the usefulness of the waters for some purposes. People are willing to allocate more of the same amount of water to energy production, but they also want more or the same amount of water for other uses. Westerners still support the traditional concept of federally subsidized water develop-

ment, although the Carter Administration is firmly against Federal investment in construction projects. In focusing on energy development the Federal Government supports subsidizing it, and an expanding Federal water development program to serve energy without depriving water users may no longer be politically feasible. While favoring energy development, people in the Western states are unwilling to endure more air and water pollution and environmental damages for energy produced in their state to be used elsewhere. It is thought that the energy policy-making process is poorly designed in elucidating the implications of energy development in changing patterns of water use and water quality. Energy development costs to the region, including the costs of reallocating water, should be recognized in the policy-making process, and the redistribution of water resources should be based on concerns other than the ability to pay. (Davison-IPA)
W79-08162

SUMMARY REPORT, SOUTHEAST CONFERENCE ON WATER CONSERVATION AND ALTERNATIVE WATER SUPPLIES, GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA NOVEMBER 8-9, 1978.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 982, Price codes: A04 in paper copy, A01 in microfiche. Southeast Water Resources, Vol. 1, No. 2, Spring 1979, 48 p, 16 fig, 4 ref. Water Resources Research Institute, North Carolina University, Raleigh. OWRT B-123-NC (3) and B-125-NC (3).

Descriptors: *Water conservation, *Water resources development, *Planning, *Alternative planning, Alternative water use, Conservation, *Water supply, Water supply development, Water demand, Alabama, Florida, Mississippi, Georgia, North Carolina, South Carolina, Tennessee, Virginia.

Formal papers, verbal presentations and associated discussion from the Southeast Conference on Water Conservation and Alternative Water Supplies are summarized. The conference met to (1) describe present and emerging conflicts for available water supplies arising out of competing demands from cities, industry, agriculture, and in-stream use; (2) examine alternative new sources of water supply; (3) consider opportunities for extending existing supplies through conservation and more efficient water use; and (4) recommend courses of remedial action to assure adequate supplies of water to meet future needs in the southeast. The conference was organized by the State water resources research institutes and State water resource agencies of the southeast. (Davison-IPA)
W79-08164

THE MISSOURI BASIN REGION'S WATER QUALITY PLANNING STRATEGY PLANNING DOSSIER. SECOND EDITION.
Federal Water Quality Control Administration, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-08174

FARMERS HOME ADMINISTRATION USE OF GRANT FUNDS FOR WATER AND WASTE DISPOSAL SYSTEMS,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 262, Price codes: A03 in paper copy, A01 in microfiche. Report CED-77-109, August 1977, 45 p, 4 appendices.

Descriptors: *Waste water disposal, *Waste disposal, *Waste disposal systems, *Grants, *Projects, *Farmers Home Administration, Government finance, Rural areas.

This report is a crituque of the Farmers Home Administration (FmHA) policy of granting less than authorized amounts for rural water and waste disposal projects. The GAO analyzed all projects receiving grants during fiscal year 1976. The analysis included 650 such projects; of these, 429, or 66%, did not receive the maximum allowable FmHA grant and 22% (143) received more than the maximum allowable grant. However, only 5% would be considered overfunded in terms of authorizing legislation in that the grant for these projects exceeded 50% of eligible project costs. The other 138 projects were evidently overfunded according to Agency regulations but not according to authorizing legislation. The FmHA indicated that its basic goal is to reduce payments to farmers and other rural residents to a reasonable level, and felt that goal had been accomplished. Adjusting grant amounts would create problems and they would oppose such adjustments because: (1) computations were based on mechanical calculation and did not consider funding priorities set by the state; (2) Agency regulations do not require 'maximum allowable grant' to be made in every case; (3) other funding factors affect final determination of grant amounts; (4) the program goals have been accomplished; and (5) adjusting grants for certain recipients could set a precedent difficult to change. Any GAO recommendations for improvement or change will be contained in a subsequent report. (Arnold-NC)
W79-08175

SURVEY OF RIVER BASIN PLANNING TECHNIQUES,
Illinois Inst., of Tech., Chicago.
F. Kudrna, C. Kueltzo, and P. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 860, Price codes: A02 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality, Chicago, Report IIEQ 74-48. October 1974 19 p.

Descriptors: *River basins, *River basin commissions, *Regional planning, *Water resources, *Illinois, Comprehensive planning, Natural resources, Water resources development, Wastewater treatment, Data collection, Survey design, Mathematical models, Computer simulation, Federal water pollution control act, State implementation plans.

This monograph describes efforts to determine what procedures and planning tools were being used by various state agencies to implement the areawide waste treatment management and river basin planning aspects of the 1972 Water Pollution Control Act Amendments (P.L.92-500). The original study attempted to collect data on the ongoing activities in these areas. Illinois and other states could review these data and use the best available techniques and approaches when implementing the river basin planning requirements of P.L.92-500. The legislative interconnections between various planning programs are listed and a description of the study's literature search is offered. The questionnaire used to assess what regional and federal agencies were doing concerning water pollution and river basin planning is described. Examples of survey questions and the federal agencies and river basin commissions to which the questionnaires were sent are listed. A state-by-state review was undertaken and the data received are summarized. It is recommended that all state programs responding to the 1972 Amendments of P.L.92-500 do so in the broadest possible context to facilitate maximum integration of water pollution control programs with other water and land use programs. A broad common data base should be compiled along with development and use of predictive modeling techniques in the related areas of water and land use planning on a regional scale. National dissemination of information is recommended; and a steering committee should be established in Illinois to define the interconnections of the various programs. (Coan-NC)
W79-08177

COMPREHENSIVE WATER QUALITY MANAGEMENT FOR THE STATE OF SOUTH DAKOTA. 303(E) BASIN PLAN FOR THE NIOBRARA RIVER BASIN,
South Dakota Dept. of Environmental Protection, Pierre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 366, Price codes: A05 in paper copy, A01 in microfiche. Report 1976. 79 p. 16 tab, 4 fig, 5 append.

Descriptors: *River basins, *Water resources development, *Water quality standards, *Water pollution sources, *Niobrara River basin(SD), *South Dakota, Water supply, Comprehensive planning, Water pollution control, Municipal wastes, Agricultural wastes, Industrial wastes, Hydrology, Flow, Soils, Antclope Creek(SD), Keya Paha River(SD), Non-point pollution.

This report presents South Dakota's strategy for correcting water pollution and thereby improving and maintaining water quality in the Niobrara River Basin. This basin is relatively long and narrow, occupying portions of three states and draining approximately 13,000 square miles. The population density is low, land development is nearly absent and consequently the basin has some of the highest quality water in the state. This plan specifies the process of planning and managing pollution abatement operations to achieve South Dakota's standards for pollution discharge to, and water quality in, Niobrara River Basin's lakes, rivers, tributaries. General information pertaining to 303(e) plans the statutory authority for planning, an analysis of federal law PL 92-500, and constitutional constraints to basin planning are presented. The report gives an in-depth profile of topography, hydrology, soils, surface water quality standards and classification of stream segments. Both point and nonpoint source pollution is described through inventories of municipal, industrial and agricultural discharges. Recommendations include revision or removal of the iron (Fe) criterion in South Dakota Water Quality Standards; increased coopcration between the U.S. EPA and local agencies; possible revision of the Keya Paha River and Antelope Creek from Water Quality Class segments to Effluent Limitation segments; and possible construction of a single wastewater treatment facility to serve both Mission and Antelope. Appendices present surface water quality standards, and the definition and significance of water quality parameters. (Coan-NC)
W79-08178

WATER NEEDS AND RESOURCES. RATIONAL MANAGEMENT: THE KEY TO THE SUPPLY-DEMAND EQUATION,
United Nations Educational, Scientific and Cultural Organization, Paris (France). Natural Resources and Environmental Sciences.
M. Batisse.
Nature and Resources, Vol. 12, No. 4, p 2-9, October-December, 1976.

Descriptors: *Water demand, *Social aspects, *Water shortage, *Water supply, *Water resources, *International water supply, Water resources management, Economics, Water requirements, Industrial water, Domestic water, Consumptive use, Withdrawal use, Irrigation water, Water pollution, Water resources planning.

This article addresses the relationship between people and their most vital material resource--water. The author warns against considering the 'water crisis' as worldwide because it tends to blur the fact that situations vary considerably from place to place. Broadly speaking, there is a water problem when demand is not matched correctly with supply. The author differentiates water demand into three sectors: domestic or municipal use, agricultural use, and industrial use; he further differentiates between consumptive use, withdrawal use, and in-stream use in each category. The international domestic water supply situation is described as one where the spread of urbanization is overtaxing water supply systems with slums occurring which lack any distribution system. The rural situation may be even worse because of lack of a dependable water supply. Agricultural demand for water arises primarily from irrigation, which requires considerable amounts of water but also renders the land extremely productive. Rapid industrialization is causing increasing use of industrial water, which may reach 80% of total water withdrawal in technologically advanced countries. It will constitute a smaller percent where irrigation competes with industry for water, but industry is more amenable to using lower quality water or recycling water. The author concludes that the world does not face a shortage of water but only a

distribution problem. It is primarily an economic and managerial problem. (Coan-NC)
W79-08182

REUSE OF MUNICIPAL WASTEWATER AND DEVELOPMENT OF NEW TECHNOLOGY--EMPHASIS AND DIRECTION NEEDED.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 5D.
W79-08183

REVIEW OF THE PRESIDENT'S JUNE 6, 1978, WATER POLICY MESSAGE.
Comptroller General of the United States, Washington, DC.
Report No. CED-79-2, November 6, 1978. 34 p, 5 append.

Descriptors: *Water policy, *Water quality, *Water resources, *Environmental quality, *Water quality standards, *Water law, *Water management(Administrative), *Groundwater management, Drinking water, Water conservation, Water pollution treatment, Waste treatment, Cost sharing, Stream channelization, Flood control, Water banking, Water supply, Groundwater resources, Federal government.

This report analyzes the implications of President Carter's June 6, 1978 Water Policy Message. Although this report commends the initiatives of the message, it notes that some of the objectives may not be met by those initiatives, namely that proposed reforms for better project cost/benefit determination, integration of water conservation principles into national water policy, and the Administration proposal to change standards to require consideration of nonstructural alternatives to a water project need to be spelled out more specifically to be effectively implemented. The GAO concludes that water policy decisions are dominated by agency self-interest, hampering effective policy making. The GAO commends the cost sharing provision but feels it does not deal adequately with requirement for states to fully justify the need for project funds. Water conservation should be encouraged by modifying assistance and loan programs; groundwater management and conservation should receive greater attention and be encouraged through agricultural assistance programs. Federal/state cooperation in water management should be enhanced. Maintenance and improvement of environmental quality requires more attention to decisions affecting water and related land resources, especially as these relate to wildlife resources, floodplains, wetlands or historic and archeological sites. The GAO concludes that there is a lack of water quality consideration in the message and that more consideration needs to be given to effects of waste disposal on water supply, quality of drinking water, elimination or reduction of nonpoint sources of pollution, recycling and reuse of water, and coordination between water quality and water supply. (Arnold-NC)
W79-08184

RESERVED WATER RIGHTS FOR FEDERAL AND INDIAN RESERVATIONS: A GROWING CONTROVERSY IN NEED OF RESOLUTION.
Comptroller General of the United States, Washington, DC.
Report to the Congress No. CED-78-176, November 16, 1978. 112 p, 8 append.

Descriptors: *Water resources, *Water rights, *Riparian rights, *Federal jurisdiction, Legal aspects, Indian reservations, Federal reservations, Regional planning, Water supply, Legislation, Federal lands.

Increasing competition for limited water resources plus recent severe droughts in the Western United States are signs that a crisis over adequate water supply may be approaching. This report describes the issues and controversies surrounding undetermined Federal and Indian reserved water rights. The report examines the nature of State water rights systems by describing the history of legal issues involved over reserved water rights and defining the two major doctrines relevant to water rights--common law riparian doctrine and appropriation doctrine. The 11 Western states where most Federal and Indian reservation lands are located have major portions of their water resources in these reservations and controversy is growing over the status of these reserved water rights. An analysis of consumptive and withdrawal use in the 11 Western states is accomplished with an analysis of Indian water demands. The report raises many questions over the definition, scope, quantification, and administration of Indian and Federal reserved water rights and compensation for these rights. The effects of reserved water rights controversies are examined in terms of landmark legal cases. Some of these cases are USA and Papago Indian Tribe v. City of Tucson and others, U.S. and Pyramid Lake Paiute Tribe v. Truckee-Carson Irrigation District and others, and Colville Confederated Tribes v. Watton. The report concludes that legislation may be necessary to resolve many of the controversial questions presented here and sends recommendations to Congress. Past and recent proposals to resolve the controversy are outlined and their shortcomings noted. These past legislative proposals consist of the Barrett, Agency, Moss, McCarran and Kiechel Bills. (Coan-NC)
W79-08185

DOMESTIC WATER DELIVERY IN BOISE, IDAHO,
Boise Center for Urban Research, ID.
R. Behling, T. Bohner, S. Brender, A. R. MacMilan, and G. Moncrief.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 890, Price codes: A07 in paper copy, A01 in microfiche. Report No. UO-LCCM-BOI-77-015, December 1977. 142 p, 3 append, 29 tab. H-2196R.

Descriptors: *Water delivery, *Water supply, *Water rates, *Municipal water, *Domestic water, *Boise(ID), Water quality, Water consumption, Utilities, Water allocation policy, Population, Bond issues, Investment, Water service, Financial impacts, Franchise agreements.

This report assesses the water distribution system in Boise as to efficiency and cost effectiveness and the possibility of converting ownership of the water supply from private to public bodies. Water in Boise City is now distributed by a multitude of corporations, private companies and wells. The question is raised as to whether this multiple approach is the most efficient and effective, and if not, what alternatives are available. The major tasks of the project are: (1) development of an historical overview of domestic water supplies in Boise; (2) to review present water suppliers and water services; (3) to investigate data available for planning for future domestic water needs; (4) to review legal considerations of city franchise agreements and ownership change; (5) to review the city administration and organization that would be impacted by converting water service to a municipal operation; (6) to review financial considerations of conversion from private to public ownership; (7) to review the experience of municipalities that have acquired domestic water systems. Data on residential, commercial, and industrial water consumption are presented with an analysis of water quality from various supplies. Quality of domestic water is generally adequate and customers are satisfied with present delivery. (Coan-NC)
W79-08186

INTERREGIONAL ADVANTAGES IN BROILER PRODUCTION: THE POTENTIAL IMPACTS OF NAVIGATION USER CHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
W. Spilka, Jr., D. Kenyon, and L. Shabman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 044, Price codes: A04 in paper copy, A01 in microfiche. Research Division Bulletin 145, November 1978. 35 p, 4 fig, 13 tab, append. OWRT B-082-VA(3).

Descriptors: *Navigation user charges, *Transportation, Transportation model, Marketing, River systems, Poultry.

The objective was to determine what effect the imposition of navigation user charges would have on the geographical location of the broiler industry. A transportation model was developed which incorporated the basic production, consumption, and cost characteristics of the broiler industry. Eight production areas were chosen. Budgets including the costs of assembling, producing, processing, and transporting broilers were formulated for each production area. The model was then evaluated under different production and cost specifications. A least-cost solution indicating production and distribution of broilers was found. Excess production capacity of 1, 3, and 5 percent was then allowed in each production area. A new pattern of production and distribution of broilers was obtained for each capacity level. The solutions indicated that high-cost northern production areas lost market share to low-cost southern producers. These alternative production specifications were then resolved with navigation user charges which recovered all public costs of operation and maintenance of the river systems added to the cost budgets of the southern production areas. The net effect of the largest proposed user charge was calculated. The new solutions indicate in all cases that the proposed maximum user charge would not affect the production and distribution of broilers.
W79-08197

INSTITUTIONAL CONSTRAINTS ON LAND MANAGEMENT FOR WATER RESOURCE PROTECTION IN URBAN AND SUBURBAN WATERSHEDS,
New York Univ., NY. Graduate School of Business Administration.
R. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 271, Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, July 1979. 69 p, 17 tab, 5 append. OWRT B-075-NY(1), 14-34-0001-8013.

Descriptors: Urban runoff, Stormwater management, *Land management, Land use, *Institutional constraints, Manpower, Street maintenance, Street cleaning, Snow removal, Catchbasin maintenance, Pesticide management, *Water pollution control, *Non-structural alternatives.

Empirical studies indicate that land management activities contribute to adverse changes in both water quality and natural hydrology. These activities are operations and maintenance functions basic to infrastructure, such as street sanitation and repair, snow removal, maintenance of parks, catchbasins and sewers, and pesticide use. This study provides insights into institutional constraints to land management for avoiding adverse water resource effects. Specifically, research relates to: (1) adaptability of land management functions to new goals; (2) relationship of an inability to establish liaisons with environmental concerns and role perceptions, organizational attributes, and manpower; (3) viability of 'networking' existing agencies for new goals for water resource goal implementation via land management. The method used was an interview questionnaire to 36 officials in 17 localities in the Lower Hudson and secondary data to discern awareness and perception of water resource planning and regulatory programs, personal background and technical procedures. Findings indicate no formal relationship between land management and water resource activities. The little connection existing is informal, nonmandatory and fortuitous, via joint functions or previous jobs. Reliance of manpower on CETA reduces training opportunities in water resources. Professional associations are a potential vehicle for creating liaison functions. In specific functional areas, street cleaning and repair rarely coordinate potentially creating a situation where street cleaning is not effective, and catchbasin maintenance and local ordinances preventing debris do not compensate. Pesticide use among local departments is also not coordinated. Information bases for all land management activities are poor and not adaptable to water resource management needs.
W79-08341

NATIONAL RESIDUALS DISCHARGE INVENTORY: AN ANALYSIS OF THE GENERATION, DISCHARGE, COST OF CONTROL, AND REGIONAL DISTRIBUTION OF LIQUID WASTES TO BE EXPECTED IN ACHIEVING THE REQUIREMENTS OF PUBLIC LAW 92-500,
National Research Council, Washington, DC. Study Committee on Water Quality Policy.
R. A. Luken, D. J. Basta, and E. H. Pechan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 288, Price codes: A11 in paper copy, A01 in microfiche. Report No. NCWQ 75/104. January 1976. 239 p, 18 fig, 66 tab, 65 ref, 7 append.

Descriptors: *Water pollution control, *Water pollution control act, *Pollution abatement, Waste disposal, Sludge disposal, Sludge treatment, Wastes, Water pollution treatment, Abatement, Legislation, Waste treatment, Sewage treatment, Costs, Cost analysis, Liquid wastes.

Work performed by consultants and staff of the Study Committee on Water Quality is described. Areas studied included regional distribution of activities or sources discharging residuals to the waters of the nation; the magnitude of such residuals; reductions expected upon achievement of the technological requirements of the 1972 Act; estimates of the distribution of the costs of achieving the requirements; and some illustrative analyses of policy implications of several alternative policies for achieving the water quality objectives of the 1972 Act. A quantitative assessment of residuals generation and discharge and of the costs of residuals discharge reduction in each of the 3,111 counties in the contiguous U.S. is presented. Compilation techniques, and data sources used are described, and findings are developed on the distribution of the diverse residuals generating activities, the relative effects of best available and best practicable technology on water quality, and the estimated costs of policies other than the imposition of national effluent limitations. (Schaefer-IPA)
W79-08345

STRATEGIES FOR RESERVING FLOWS FOR FISH AND WILDLIFE; IDENTIFICATION, DESCRIPTION, AND PRELIMINARY EVALUATION,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
R. L. Dewsnup, and D. W. Jensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 243, Price codes: A99 in paper copy, A01 in microfiche. February, 1977, 549 p.

Descriptors: *Western United States, *Water resources, *Regulation, *Stream flow, Water quality, Conservation, Fish, Wildlife, Legal aspects, Federal government, State governments, Ecology.

Strategies available under existing law in 13 western states for reserving fish and wildlife flows are identified, described and evaluated. This study was prompted partly because western appropriation law developed to accommodate diversions from watercourses for economic development, with little consideration to protecting instream values. Consequently, many difficulties were encountered with subsequent efforts to protect instream flows. The instream uses neither: (1) satisfied the appropriation law requirement of a physical diversion from the watercourse nor (2) qualified as a 'beneficial use'. In addition to state strategies, federal strategies under statutes, regulations and programs are discussed. The extent to which interstate compacts may serve to protect or reserve instream flows is evaluated. A summary report contains 25 strategies of the 75 identified, as candidates for further study. There are many citations to statutes, cases and administrative regulations. (Ewing-Florida)
W79-08401

LESSONS FROM A WET STATE,
Conservation Law Foundation of New England, Inc., Boston, MA.
A. Dawson.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Va., U.S. Dept. of the Interior, Washington, D.C., p 185-95, 1978.

Descriptors: *Massachusetts, *Wetlands, *Flood plain zoning, *Flood plains, Water law, Land use, Land management, Zoning, Permits, Property values, Priorities, Environment, Regulation.

For almost 15 years, Massachusetts has rejoiced in a variety of laws designed to protect wetlands and floodplains. This regulatory activity has produced much litigation, and eight cases decided by the Supreme Judicial Court of the Commonwealth Supreme Court. The Massachusetts statutes are the pattern of the laws of many other states; and Massachusetts' legal decisions may be precursors of results in other quickly urbanizing areas. An extensive analysis of Massachusetts Statutes on wetland protection and cases decided under those is presented. Of particular interest is the third decision by the Supreme Court of MacGibbon v. Board of Appeals of Duxbury. 'MacGibbon III' has alarmed environmentalists because it may suggest a conservation backlash against the prior trend of affording greater weight to environmental values. It is impossible to predict the outcome of 'taking issue' cases. The argument most likely to prevail over private rights is the prevention of public hazards. Local zoning is an acceptable way to protect floodplains and wetlands, whether or not statewide statutes exist. Suggested necessary elements of an acceptable ordinance are given. (Coffey-Florida)
W79-08402

BACTERIA CRITERIA,
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08403

OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1977,
Energy and Natural Resources Committee (U.S. Senate), Washington, DC.
Report Senate Comm. on Energy and Natural Resources, Report No. 95-284, 95th Cong., Ist Sess (1977), 228 p.

Descriptors: *Continental shelf, *Oil spills, *Offshore platforms, Fish conservation, Oil pollution, Natural gas, Energy, Environmental effects, Environment, Exploration.

Because of the increasing national need to produce more energy, the 1977 Outer Continental Shelf Lands Act Amendments were enacted. Among the purposes of these amendments are: (1) establishment of policies and procedures for managing the oil and natural gas resources of the Outer Continental Shelf (OCS), with the intent to expedite exploration and development; (2) preservation, protection and development of oil and natural gas ensuring a balance between orderly energy resource development and protection of the human, marine, and coastal environments; (3) encouragement of new technology to minimize risk of environmental damage; (4) minimization or elimination of conflicts between the exploration, development and production of oil and natural gas, and the recovery of other resources such as fish and shellfish; (5) establishment of an oilspill liability fund. This fund would pay for the prompt removal of any oil spilled or discharged as a result of OCS activities, and for any damages to public or private interests caused by such spills: and (6) establishment of a fisherman's Contingency Fund to pay for damages to commercial fishing vessels and gear due to OCD activities. (Coffey-Florida)
W79-08404

SOME LEGAL ASPECTS OF WATER RESOURCES MANAGEMENT,
J. W. Jensen.
Public Administration Review, Vol. 37, No. 5, p 456-62, 1977.

Descriptors: *Water management(Applied), *Riparian rights, *Appropriation, *Water distribution(Applied), Water quality act, Administration, Public rights, Water law, Water rights, Water resources, Water supply.

Some of today's water problems cannot be adequately solved through traditional water management techniques. There must be more efficient water use and more emphasis on improving water management. For the Western states under the appropriation doctrine, the courts were not able to control the controversy between 'first in time, first in right' competing users. There now exists a comprehensive statutory scheme for the administration and management of water resources in every western state. A three-fold approach of appropriation, distribution and adjudication by a 'state engineer' is used. Statutory adjudication procedures have solved the problem of lack of integration of existing rights. All users of a common water body are joined in a single action to define each user's rights. In the east, under the riparian doctrine, riparian owners traditionally were allowed to make reasonable user of the water supply so long as the use did not unreasonably interfere with other riparian owners. Now these states are moving to limit riparian rights and have adopted permit systems to control future water uses. (Corey-Florida)
W79-08405

COASTAL ZONE MANAGEMENT PROGRAM DEVELOPMENT AND APPROVAL REGULATIONS.
Federal Register, Vol. 44, No. 61, p 18590-624, March 28, 1979. 1 fig, 3 tab.

Descriptors: *Coasts, *Water management(Applied), *Federal government, Federal jurisdiction, Regulation, State governments, Coastal plains, Coastal structures, Environmental effects, Environmental control, Waste disposal.

These final regulations reflect the most current and accurate interpretation of program approval requirements of the Office of Coastal Zone Management (OCZM). They revise and supersede the Interim-Final Program Development and Approval Regulations published in the Federal Register on March 1, 1978. The primary purpose of these regulations is to set forth the requirements for state coastal management program approval by the Assistant Administrator for Coastal Zone Management pursuant to the 1972 Coastal Zone Management Act as amended. Included are the grant application procedures for both program development and program implementation funding. Conditions under which grants may be terminated are set forth. The specifics of these requirements are subsumed under the following headings: General Requirements; Uses Subject to Management; Special Management Areas; Boundaries; Authorities and Organization; Coordination; Public Involvement and National Interest; and Miscellaneous. All relevant sections of the Act are dealt with under one of these groupings, but not necessarily in the order in which they appear in the Act. (Coffey-Florida)
W79-08406

INDIAN WATER RIGHTS FOR MINERAL DEVELOPMENT,
P. C. Maxfield, M. F. Dietrich, and F. J. Trelease.
In: Natural Resources Law on American Indian Lands, p 207-238, 1977. Rocky Mountain Mineral Law Foundation, Boulder, Colorado.

Descriptors: *Water rights, *Indian reservations, *Water allocation(Policy), Prior appropriations, Water control, Water policy, Water resources, Water shortage, Water sources, Water supply

The doctrine of 'reserved water right' for Indians began in 1908 Supreme Court decision of Winters v. United States. The creation of an Indian reservation in a western state also created a water right that would enable the Indians to live on and use the reservation's land. The Indians were given a superior right to water flowing through the reservation over prior water users. The water which had previously irrigated the off-reservation land had to be re-diverted to the Indian land. The Indian water right available for mineral development under the 'Winters Doctrine', may bring seri-

ous conflict with other water users. The state and federal water law background and areas of conflict between them are detailed. The basic theory of the Winters Doctrine and its intended purpose are explained. Which lands and water come within the 'reserved rights' category is discussed. The permitted uses and the quantity of the water use are examined. The transfer of 'reserved rights' to mineral operators and the adjudication of reserved rights are included. (Coffey-Florida)
W79-08407

OFFSHORE LEASING - A SHOWDOWN BETWEEN BIG OIL AND BIG GOVERNMENT,
D. Kirschten.
National Journal, Vol. 9, No. 50, p 1924-28, December 10, 1977, 2 tab.

Descriptors: *Continental shelf, *Oil industry, *Legislation, *Regulation, Legal aspects, Federal government, Environmental effects, Local governments, Drilling, Inter-agency cooperation, Natural resources.

Comprehensive amendments to the 1953 Outer Continental Shelf Lands Acts (OSCLA) are expected to create a showdown between Big Oil and Big Government. At issue is the nation's hunt for new ocean petroleum resources and the management of that quest. The major petroleum firms have lobbied against any changes in the 1953 OCSLA. They contend that new provisions are not needed because of the administrative regulations promulgated under the authority of existing law. The American Petroleum Institute states that the Administration-supported bill should be defeated because it would permit direct federal government involvement in wildcat drilling for offshore oil and gas. This would open the door to the creation of a Federal Oil and Gas Corporation. Actually, the pending legislation simply provides several options for pre-lease test drilling into the geological structures that are likely repositories of offshore petroleum resources. The pending OCSLA amendments also attempt to address concerns of coastal communities which may be affected by offshore oil drilling. Despite the rough seas that the OCSLA reforms have encountered, backers of the bill express confidence that their bill will be passed. (Ewing-Florida)
W79-08408

FINANCIAL RESPONSIBILITY FOR WATER POLLUTION-OUTER CONTINENTAL SHELF (FINAL RULE).
Federal Maritime Commission, Washington, DC.
Federal Register, Vol. 44, No. 55, p 16918-32, March 20, 1979.

Descriptors: *Water pollution, *Oil spills, *Continental shelf, Oil, Oil pollution, Oil industry, Regulation, Transportation, Federal government.

The Federal Maritime Commission issued regulations affecting persons who own and operate vessels carrying oil from offshore facilities over the Outer Continental Shelf. The 1978 Outer Continental Shelf Lands Act Amendments imposes upon such vessel owners and operators a new liability for damages and removal costs resulting from oil discharges. Vessel-operators must demonstrate their financial capability of meeting such potential liability up to certain limits, before their vessels may lawfully engage in any segment of oil transportation from an offshore facility above the Outer Continental Shelf. These regulations set forth the manner by which Financial responsibility can be demonstrated to the Commission. They provide for the issuance of Certificates of Financial Responsibility which must be carried aboard vessels and presented upon request to officials or designees of the U.S. Coast Guard. Vessels having on board Outer Continental Shelf produced oil, which has been brought ashore or loaded as a result of oil spill removal operations, are not subject to these regulations. (Coffey-Florida)
W79-08409

OFFSHORE OIL POLLUTION COMPENSATION FUND AND CLAIMS PROCEDURES (FINAL RULES).
Coast Guard, Washington, DC.
Federal Register, Vol. 44, No. 54, p 16860-77, March 19, 1979.

Descriptors: *Water pollution control, *Oil spills, *Continental shelf, Oil, Oil pollution, Oil industry, Regulation, Water quality, Water pollution.

These final regulations are required to implement the recently enacted Offshore Oil Pollution Compensation Fund. This fund is available for certain removal costs and damages caused by oil pollution from Outer Continental Shelf (OCS) activities. The regulations are intended to convey the policies, uniform procedures, and administrative practices regarding the overall management and general operation of the fund. Part 135-Offshore Oil Pollution Compensation Fund-prescribes the policies, procedures, and administrative practices regarding offshore oil pollution liability and compensation, including the administration and general operation of the fund established under Title III of the 1978 Outer Continental Shelf Lands Act Amendments (OCSLA). Part 136-Offshore Oil Pollution Compensation Fund Claims Procedures-prescribes uniform procedures and standards for the settlement of claims against the Fund for economic loss, including removal costs resulting from or arising out of oil pollution from certain OCS activities as authorized by and in accordance with Title III of the OCSLA. (Coffey-Florida)
W79-08410

OIL AND GAS EXTRACTION POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS (FINAL AND INTERIM FINAL RULES).
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 44, No. 73, p 22069-78, April 13, 1979.

Descriptors: *Pollutant identification, *Pollution abatement, *Oil pollution, Regulation, Federal government, Control systems, Offshore platforms, Agricultural watersheds, Coasts, Water utilization, Industrial water.

Final effluent limitation guidelines establishing 'best practicable control technology currently available' (BPT) are promulgated. These guidelines are for offshore, onshore, coastal and agricultural and wildlife water use subcategories in the oil and gas extraction industry. These final regulations combine the near and far offshore subcategories into a single offshore subcategory. The 'beneficial use' subcategory is renamed the 'agricultural and wildlife water use' subcategory. The definition of the stripper subcategory is clarified. The federal Environmental Protection Agency does not yet have sufficient technical data to promulgate effluent limitations for the stripper subcategory. These sections remain reserved. There are interim final rule changes in the descriptions and applicability of the coastal and agricultural and wildlife water use subcategories. Comments on these interim final changes are solicited. The limitation guidelines are based upon the application of BPT as defined in section 304 (b) of the 1977 Clean Water Act. The effective date was April 13, 1979. (Coffey-Florida)
W79-08411

PUBLIC PARTICIPATION IN PROGRAMS UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT, THE SAFE DRINKING WATER ACT AND THE CLEAN WATER ACT.
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 44, No. 34, p 10286-97, February 16, 1979.

Descriptors: *Public access, *Solid wastes, *Decision-making, *Pollution abatement, Federal government, Administrative agencies, Adoption of practices, State government, Administrative decisions, Regulation.

These regulations are intended to encourage, provide for, and assist public participation under the Resource Conservation and Recovery Act, the Safe Drinking Water Act, and the Clean Water Act. They replace existing regulations for public participation in solid waste management. 'The Public' in the broadest sense means the general populace. The regulations include general provisions which require open government processes and efforts to promote public awareness of the decision-making process as to programs and activities under the three Acts. Requirements applicable to specific public participation mechanisms, such as, public hearings and advisory groups are included. These regulations do not require the use of the specific mechanisms. The mechanisms must be used only if required in program regulations. The regulations are also designed to ensure government responsiveness to and awareness of public concerns. (Coffey-Florida)
W79-08412

THE CLEAN WATER ACT OF 1977,
J. W. Raisch.
Colorado Lawyer, Vol. 7, No. 4, p 536-49, 1978.

Descriptors: *Colorado, *Federal water pollution control act, *Industrial waste, Environmental control, Toxins, Water quality control, Water quality standards, Waste treatment, Water pollution control, Water pollution treatment.

In December, 1977 Congress enacted amendments to the Federal Water Pollution Control Act (FWPCA). While the amendments contain significant changes or additions to the FWPCA, they do not change the basic statutory scheme set forth in the amendments enacted in 1972 by PL 92-500. The amendments that may be of significance to Colorado lawyers dealing with water pollution control are discussed. Compliance deadline extensions to July 1, 1983 have been provided in the areas of industrial point sources and municipal services for such reasons as lack of federal funds. The amendments changed 'best available technology' for industrial sources to a new standard called 'best conventional pollutant control technology'. Changes were made to the toxic pretreatment requirements and to best management practices for industry. These could significantly affect the mining industry in Colorado. As to dredge and fill permits, the Army Corp of Engineer's authority was changed and some exemptions were provided for activities such as congressionally authorized federal projects. Other changes discussed are areawide waste treatment management, water rights and irrigation return flows, and grants for treatment works construction. (Corey-Florida)
W79-08413

THE LAW OF THE SEA: RETHINKING U.S. INTERESTS,
R. Darman.
Foreign Affairs, Vol. 56, No. 2, p 373-95, January 1978.

Descriptors: *Law of the sea, *International waters, *Treaties, *United States, Research priorities, Taxes, United Nations, Foreign countries, Foreign waters, Conferences, Deep water.

Evaluated are the status of negotiations in the Law of the Sea Conference, the past United States' negotiating policy, and the changes which are necessary in United States' negotiating tactics. Earlier emphasis placed on national security and efforts to stem 'creeping jurisdiction' or foreign states is criticized. The deep seabed provisions of the Informal Composite Negotiating Text have been termed fundamentally unacceptable by the United States. Why this was a good decision from tactical and substantive standpoints is discussed. Three adjustments in negotiating tactics are suggested: (1) The United States should exhibit a willingness to accept Conference failure as a non-disastrous, thoroughly tolerable, outcome; (2) It should deliberately seek to breakdown polarization between the developed and developing nations. This is not to be accomplished by concession, but by greater practical attention to, and argument on behalf of, interests that cut across these lines; (3) As a hedge against conference failure and incitement toward success, it should proceed with the development of a 'mini-treaty' outside the conference framework. (Walker-Florida)

W79-08414

A CONFERENCE OF THE MINERAL ESTATE INCLUDES A TRANSFER OF GEOTHERMAL RESOURCES,
S. C. Suklett.
Tulsa Law Journal, Vol. 13, No. 4, p 856-63, 1978.

Descriptors: *Water rights, *Geothermal studies, *Mining, Water law, Natural resources, Energy, Subsurface flow, Subsurface waters, Geysers, Water temperature.

The United States has become increasingly aware of its diminishing fossil fuel resources. One alternative energy source of increasing importance is geothermal energy. In Geothermal Kenetics, Inc. v. Union Oil Co., a California court held 'that the grant of mineral in, on or under the property includes a grant of geothermal resources, and the steam therefrom'. In Reich v. Commissioner, the Tax Court found that geothermal steam developers could use depletion allowance provided by Internal Revenue Code because steam was both a valuable resource and a gas. In United States v. Union Oil Co., the Ninth Circuit Court concluded that geothermal resources were within the meaning of the mineral reservation in the Stock-Raising Homestead Act. The problems created by treating geothermal water as a mineral, may be far more troublesome when other types of geothermal systems are involved. For example in a hot water system there may be an interchange between the geothermal and subsurface water. By requiring water rights to be conveyed separately from geothermal exploitation rights, some progress may be made toward solving problems from geothermal water withdrawal. (Fortin-Florida)
W79-08415

WATER AND WATERCOURSES - RECREATIONAL RIGHTS - A DETERMINATION OF THE PUBLIC STATUS OF WEST VIRGINIA STREAMS,
G. Castelle.
West Virginia Law Review, Vol. 80, Nos. 2-3, p 356-368, Winter, 1978.

Descriptors: *West Virginia, *Watercourses(Legal aspects), *Recreation facilities, *Recreation demands, Common law, Streams, Transportation, Public rights, Public access, Recreation, Water law.

At the turn of the century, the West Virginia streams provided the transportation network for a flourishing lumber industry. Although the streams are no longer so used, a stream's capacity to sustain logging activity survives as the common law test to determine the state's public waters. Since the public waters test was designed to accommodate bygone commercial practices it is ill-suited to a determination of present recreational rights. The development of the West Virginia public waters test is presented. An analysis of federal and state approaches is given. As the public needs changed, so too has the public water test. Now the need has again shifted from commercial traffic to recreational uses. The public waters test need change accordingly. Underlying the public waters issue is a determination of whether the state definitions are principally designed to provide for public commerce or public use. If the definition of Public Waters is designed to provide for public use, then the public waters test must be modified so that present rights reflect present conditions. (Coffey-Florida)
W79-08416

PUBLIC ACCESS TO OCEAN BEACHES: IF YOU FIND A PARKING SPACE, HOW DO YOU GET TO THE BEACH,
North Carolina Univ. at Chapel Hill. Urban and Regional Studies Center.
D. Brower, and W. Dreyfoos.
Coastal Zone Management Journal, Vol. 5, No. 1/2, p 61-81, 1979.

Descriptors: *Public access, *Beaches, *Recreation facilities, Land use, Recreation, State governments, Legislation, Federal government, Eminent domain, Easements, Prescriptive rights.

Beach and ocean recreational resources cannot be enjoyed and appreciated unless government finds ways to guarantee passage to those beaches. As more of out privately-owned beachlands are developed and the public are kept out, government must find ways to ensure continued public access where it already exists, and develop new access ways. A variety of means for increasing public access are suggested: (1) state legislation; (2) purchases of fee-simple title; (3) purchases of easements; (4) prescriptive easements; (5) eminent domain; (6) dedication; (7) trades; (8) after hurricane acquisitions; (9) land-use controls; and (10) federal programs. Governments are more likely to look to these tools as federal funds increase for coastal zone management. Should federal funding not materialize, state and local governments should plan for and acquire increased public beach access. National and state coastal recreational planning and management agencies should strive for expanding opportunities for public beach use, with increased public access as the first step. Included are 57 references. (Coffey-Florida)
W79-08417

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
E. DiSanto.
North Carolina Central Law Journal, Vol. 9, No. 2, p 192-207, 1978.

Descriptors: *Wild rivers, *North Carolina, *Administrative agencies, *New River, Rivers, Federal power act, Political aspects, Legislation, Judicial decisions, Water resources, Environmental control.

The evolution of the controversy surrounding the New River is traced. The long-awaited test case for the Wild and Scenic Rivers Act (WSRA), North Carolina v. FPC is examined. The effects of the District of Columbia Circuit Court's interpretation of this Act are: (1) an unjustifiable limitation on the individual states ability to safeguard unique rivers; (2) a failure to impose statutorily mandated burdens on the Federal Power Commission (FPC); (3) a frustration of the Congressional intent to create an autonomous statutory mechanism for environmental protection; (4) inevitable ad hoc protective legislation; and (5) a failure to consider the interrelationships of the statutory provisions of the WSRA, the National Environmental Policy Act (NEPA), and the Federal Power Act. In light of the New River Case, this interrelationship is examined. A statutory framework of accommodations is proposed. Through the NEPA, Congress intended to create an integrated autonomous structure for environmental protection. The Circuit Courts decision undermines this structural integration by eliminating local discretion. Similarly, the FPC action undermine the NEPA objectives, as they failed to adequately assess all environmental alternatives. Departure from the structural approach of NEPA subjects environmental planning and decision-making to the happenstance. (Fortin-Florida)
W79-08418

STATEHOOD AND THE EQUAL FOOTING DOCTRINE: THE CASE FOR PUERTO RICAN SEABED RIGHTS.
Yale Law Journal, Vol. 88, No. 4, p 825-49, March 1979.

Descriptors: *Puerto Rico, *Federal-state water rights conflicts, *Continental shelf, Constitutional law, Political constraints, Federal government, Political aspects, State government, State jurisdiction, Resources, Water law.

Soon, negotiations between Puerto Rico and the United States will probably explore statehood as an alternative to the island's current commonwealth status. Political pressures for Puerto Rican demands for exclusive rights to exploit its surrounding seabed will probably meet with opposition based on the 'equal footing doctrine (doctrine)'. That doctrine prevents extension of a state's sovereignty into the domain of the United States' political and sovereign power from which other states have been excluded. A new historical analysis of the doctrine is presented demonstrating that the doctrine poses no barrier to such an extensive seabed grant upon Puerto Rico's admission into the Union. The submerged lands issues left unsettled by the case law are defined. A framework is derived for the doctrine from a historical analysis of submerged lands and equal footing cases. This framework is applied to Puerto Rico's claims. How Congress may cede seabed rights to the island on admission is demonstrated. The language and limitations of such an agreement are considered. (Coffey-Florida)
W79-08419

THE CLEAN WATER ACT OF 1977: GREAT EXPECTATIONS UNREALIZED,
M. J. Miars.
Cincinnati Law Review, Vol. 47, No. 2, p 259-71, 1978.

Descriptors: *Water pollution control, *Federal water pollution control act, *Cost-benefit analysis, Environmental control, Costs, Cleaning, Pollution abatement, Political constraints, Legislation, Industries.

On December 27, 1977, President Carter signed into law the 1977 Clean Water Act. The signing marked the end of a two-year struggle over adjustments to the Federal Water Pollution Control Act (FWPCA). Although certain groups were disappointed by the 1977 modifications, both industry and environmentalists generally were pleased with the viable compromise that emerged. Selected 1977 FWPCA amendments are examined for their future effectiveness. A brief history of water pollution control in the United States is included. A brief analysis is presented of the 1899 Refuse Act, the 1948, 1956, 1961, 1972 and 1977 Federal Water Pollution Control Act, 1965 Federal Water Quality Act and The 1966 Clean Water Restoration Act. Industry and environmentalist reaction to the 1977 amendments to the 1972 Clean Water Act are also discussed. The benefits of water pollution control must be evaluated in light of a normative policy. The long-term advantages of an enhanced quality of living must be recognized without focusing solely on an ever-increasing material lifestyle. (Coffey-Florida)
W79-08420

THE CLEAN WATER ACT OF 1977: MID-COURSE CORRECTIONS IN THE SECTION 404 PROGRAM,
J. R. Curtiss.
Nebraska Law Review, Vol. 57, No. 4, p 1092-1112, 1978.

Descriptors: *Federal water pollution control act, *Navigable waters, *Pollution abatement, Political aspects, Water pollution control, Water pollution sources, Political constraints, River and harbors act, Dredging, Jurisdiction.

Congress enacted the 1972 Federal Water Pollution Control Act (FWPCA) intending to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The likelihood of success is in large part dependent upon the section 404 dredge and fill program. The precise nature and extent of Army Corps of Engineers jurisdiction under section 404, has been a subject of continuing controversy. A conflict has existed between the congressional intent to expand the definition of navigable waters under the FWPCA and the Corps' continuing committment to a limited jurisdiction. This prompted Congress to reexamine the section 404 provisions. In adopting the 1977 amendments, Congress made a number of crucial changes in the dredge and fill program as it existed under the FWPCA. Foremost among these was the decision to retain the road jurisdictional approach in regulating dredge and fill activities, although the manner of control was substantially altered. The amendments provide for state implementation of the permit program for all navigable waters within a state's jurisdiction. (Fortin-Florida)
W79-08421

YUGOSLAV LAW ON MARITIME, INLAND NAVIGATION,
Joint Publications Research Service, Arlington, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as JPRS 69819, Price codes: A14 in paper copy, A01 in microfiche. September, 1977, 308 p.

Descriptors: *Law of the sea, *Navigation, *International water, *Foreign countries, Regulation, Inland waterways, Ships, Boating regulations, Port authorities, International law, Water law.

This law of the Socialist Federal Republic of Yugoslavia regulates the following: (1) the basic safety elements of navigation on the sea and inland waters of Yugoslavia; (2) safety of navigation on waterways in the coastal sea and inland waters of Yugoslavia over which the international or intergovernmental rules prevail; (3) basic legal relations concerning vessels as property; (4) contractual and other binding relations pertaining to vessels; and (5) procedures relating to ship registration, limitations of water carriers, liquidation of general average losses, and execution and attachment of ships as security. The provisions of this law apply to: (1) maritime vessels and inland vessels which have Yugoslav nationality; (2) navigation in the coastal sea and inland waters of Yugoslavia; and (3) the relations which arise in connection with that navigation, unless the law states otherwise. (Vloedman-Florida)
W79-08423

WATER QUALITY STANDARDS, NAVIGABLE WATERS OF THE STATE OF MISSISSIPPI (FINAL RULE),
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 44, No. 84, p 25223-28, April 30, 1979.

Descriptors: *Mississippi, *Water quality standards, *Dissolved oxygen, *Navigable waters, Water quality, Water quality control, Water uses, Regulations, Federal government, Surface waters, Water law, Pollution abatement.

The federal Environmental Protection Agency (EPA) has promulgated a final rule establishing a dissolved oxygen criterion for all water uses recognized by Mississippi. This criterion is less stringent than originally proposed by EPA because testimony and data submitted at the public hearings and otherwise available to EPA indicated that a balanced aquatic organism population can be maintained at this criterion level in Mississippi waters. The proposed rule would have required all Mississippi surface waters to achieve a minimum dissolved oxygen concentration of 5.0 mg/1. The final rule amends that proposed rule by replacing the phrase, 'at a daily average of not less than 5.0 mg/1 with a daily instantaneous minimum of not less than 4.0 mg/1.' The criterion should be applied under the conditions contained in Section I of the State's standards. Wasteload allocations must be performed to achieve the dissolved oxygen criterion. This rule was effective May 30, 1979. (Coffey-Florida)
W79-08424

TEMPERATURE (TEMPERATURE STANDARDS FOR NATIONWIDE WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 4C.
W79-08425

CONGRESS MAKES WAVES OVER CARTER'S WATER POLICY,
D. Kirschten.
National Journal, Vol. 10, No. 26, p 1052-56, July 1, 1978.

Descriptors: *Water policy, *Federal government, *Federal budget, Legislation, Cost-benefit analysis, Natural resources, Water conservation, Estimated costs, Regional analysis, Legal aspects.

President Carter is ready to resume the building of new projects to harness the nation's water resources. He has sent Congress a list of jobs which involve harbor improvements, flood protection measures, a new hydropower unit, and rehabilitation work for western irrigation and water supply systems. Congress, by tradition, has had little concern with White House desires about water projects. Congress views this area as particularly its domain. The Administration's differences with Congress go well beyond budgetary questions. Carter's proposals emphasized expenditures to promote water conservation and acquire flood-prone lands, rather than the building of structures to protect them. Among the projects approved by the House, there is a much heavier emphasis on structural solutions and assistance to the barge industry. In order to make the best use of limited budgetary resources, the Administration has weighed water projects against standards designed to stress a realistic evaluation of the economical and environmental costs and benefits. The final question remains. Who, the President or Congress, will have the last word as to whether the criteria have been met. (Ewing-Florida)
W79-08426

GOVERNORS SEEK A WATER POLICY THAT HAS SOMETHING FOR EVERYONE,
D. Kirschten.
National Journal, Vol. 10, No. 11, p 432-35, March 18, 1978.

Descriptors: *Water policy, *State governments, *Federal government, Federal budget, Conservation, Regional economics, Regional analysis, Water supply, Water requirements, Water demand.

As the Carter Administration ponders its next step to cut off federal subsidies that encourage wasteful water uses, the nation's governors have united to urge that federal water funds be more widely disbursed. The governors are seeking a stronger role in water resource decisions. They want to assure that any national water policy will maintain the economic health of each of their regions. Their strategy has been to side-step regional rivalries and unite behind a common framework. If the President's objectives were simply to save water, he would agree with much in the governor's statement of principles, which includes a strong commitment to water conservation and other Carter-proposed reforms. Carter does not so much consider water an endangered resource as he does federal tax dollars. The governors share Carter's recognition that future spending on water projects must be planned carefully, with greater attention given to cheaper alternatives. However, they think planning - subject to federal criteria - should be performed at the state level. (Ewing-Florida)
W79-08427

MIXING ZONES (RECOMMENDATIONS FOR A NATIONWIDE STRATEGY FOR WATER QUALITY MANAGEMENT).
Environmental Protection Agency, Washington, DC. Div. of Water Quality Standards.
For primary bibliographic entry see Field 5A.
W79-08428

WETLANDS PROTECTION EFFORTS, NEEDS AND PRIORITIES IN WISCONSIN,
Wisconsin Univ.-Madison.
B. Bedford.
In: Proceedings of the National Wetlands Protection Symposium, June 6-8, 1977, Reston, Va., U.S. Dept. of the Interior, Washington, D.C., p 63-68, 1978, 7 ref.

Descriptors: *Wisconsin, *Wetlands, *Priorities, Regulation, Ecosystems, Agriculture, Environment, Navigable waters, High water mark, Drainage programs, Zoning, Protection.

Wisconsin's original wetland endowment approached 10 million acres. Somewhat less than 2.5 million acres remain as functioning wetlands. Many of these are significantly degraded. Wetland protection in Wisconsin has resulted from the relationship of wetlands to navigable water bodies. The relationship brings some wetlands within the domain of the public trust and the State Shoreland Zoning Program. The domain of Public Trust Doctrine and navigable waters in Wisconsin are analyzed. The State determines the limits of its regulatory authority in navigable waters on the ordinary high water mark (OHWM). There is an overview of the efforts to protect wetlands through the courts and the regulatory process. A rigorous and critical review of state and federal subsidies to wetland drainage should be undertaken. An active, aggressive and consistent enforcement program of existing wetland laws is needed, especially as to Wisconsin's Public Trust doctrine & Shoreland Zoning Program. (Coffey-Florida)
W79-08429

COASTAL ZONE MANAGEMENT AND PLANNING IN CALIFORNIA: STRATEGIES FOR BALANCING CONSERVATION AND DEVELOPMENT,
J. M. Davidson.
Urban Law Annual, Vol. 15, p 253-79, 1978.

Descriptors: *California, *Coasts, *Shore protection, *Future planning(Projected), Seashores, Legal aspects, Conservation, Natural resources, Legislation, Public rights, Judicial decisions, Management, Planning.

The need for new mechanisms of allocating shoreline resources is underscored by the continued pressure of population and urban growth in coastal regions, and the rapid conversion of estuarine areas to developmental uses. In California, an innovative coastal management strategy has been operative on a regional scale since 1965, and for the entire California coast since 1972. The California coastal program is currently in transition between state interim controls and a predominantly local planning and management system. As the regional commissions are phased out, the permanent local-state system should develop more explicit criteria for balancing conservation and development interests. The California coastal zone management approach may serve as a model for other state programs. The planning and management policies of the 1976 California Coastal Act are the guiding force behind California's present program. The policies establish objectives and priorities for land and water use within the coastal zone without specifying particular uses for individual parcels. By ranking uses according to established priorities without specifying land and water allocations, California avoids challenges and inflexibilities that can emerge from a direct coastal master plan. (Ewing-Florida)
W79-08430

BASES FOR THE LEGAL ESTABLISHMENT OF A PUBLIC RIGHT OF RECREATION IN UTAH'S 'NON-NAVIGABLE' WATERS,
R. Kruth.
Journal of Contemporary Law, Vol. 5, No. 1, p 95-110, Winter, 1978.

Descriptors: *Utah, *Public rights, *Non-navigable waters, *Recreation facilities, Population, Water resources, Prior appropriation, Riaprian rights, Public access, Water law, Streams, Legal aspects.

Since World War II, the dramatic growth in population, amounts of leisure time, and the tourism industry has placed great demands on Utah's water resources and recreational facilities. In Utah, the public's right to use the surface overlying a privately-owned stream bed has remained largely undefined. Various methods by which disputes over surface use rights have been settled in the public's interest are examined. How the same result could be realized within existing Utah law is presented. Ample opportunities exist in Utah law for the establishment of a public right to use non-navigable waters. The best approach is one based on public ownership of water and the usufructuary nature of Utah's water rights. This theory would serve to recognize and confirm public rights in the maximum amount of water suitable for recreation without tying the public right to outmoded notions of navigability. This theory is used in several neighboring states of similar situations and fits well

within the doctrine of prior right of appropriation. (Coffey-Florida)
W79-08431

THE CHANGING WATER MARKET FOR ENERGY PRODUCTION,
McGeorge School of Law, Sacramento, CA.
F. Trelease.
Journal of Contemporary Law, Vol. 5, No. 1, p 83-93, Winter 1978.

Descriptors: *Economic efficiency, *Energy, *Economic feasibility, Economics, Coal mines, Cost analysis, Cost allocation, Water utilization, Water zoning, Prior appropriation, Political constraints.

The legal arrangements for water use should parallel the economic structure to enable and facilitate changes in the water market. Water law should provide for maximum use benefits by granting private water rights. This private grant should be secure enough to encourage development and flexible enough to allow economic forces to change the grant to better uses. These rights should be subject to public regulation only when private economic action fails to protect the public interest. Unfortunately, the market in water rights works very poorly. The political and economic difficulties in shifting a water resource from a lower to a higher productive use in the market is analyzed. Specific attention is given to the need to shift from agricultural uses to coal industrial uses in some western states. The 'spillover' costs in any water rights transfer are considered. Only when everyone affected by transfer 'spillover' costs is brought into the negotiations will equity be achieved. (Coffey-Florida)
W79-08432

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
P. G. Rowe, J. Mixon, B. A. Smith, J. B. Blackburn, Jr., and G. L. Callaway.
Ballinger Publishing Company, Cambridge, Massachusetts, 1977. 272 p, 10 fig, 10 tab. ENV 73-07880 A02.

Descriptors: *Local government, *Community development, *Rural areas, *Economic impact, Economics, Governmental interrelations, Management, Alternative planning, Ecology, Population, Natural resources.

Governmental environmental initiatives are carried out by a complex management system that incorporates federal, state and local governments. Appropriate levels of local government responsibility for environmental management and available courses of action are described. A potential shape of future involvement of local government in the overall environmental management process is suggested. Generally focused upon are natural resource consumption, pollution issues and other environmental impacts that impair environmental quality and affect the continuing process of community development. Special attention is given to development in rural areas on the urban fringes where for the first time in United States history, population is growing faster than in metropolitan areas. There are eight chapters: Chapter (1) is an introduction; (2) examines the social costs of environmental management; (3) looks at environmental management from an ecological view; (4) discusses the evolution of public sector activity in environmental management; (5) is on recent environmental laws; (6) includes institutional arrangements; (7) local responses to current legislative requirements; and (8) summarizes the major conclusions and suggests the alternative futures available to local governments in reconciling human purposes and environmental realities. An extensive bibliography is included. (Coffey-Florida)
W79-08467

WATER POLLUTION CONTROL (ASSESSING THE IMPACTS AND COSTS OF ENVIRONMENTAL STANDARDS),
R. A. Luken, and E. Pechan.
Praeger Publishers, New York, 1977. 180 p, 13 fig, 48 tab, 3 append.

Descriptors: *Water pollution control, *Cost analysis, *Federal water pollution control act, Industries, Municipal wastes, Water quality, River basins, Regional analysis, Environment, Water law, Pollution abatement.

Increasing public concern over environmental degradation caused by unchecked water pollution has resulted in a trend toward an increasing federal government responsibility. One of the key policy changes enacted into law by Congress in 1972 is addressed - that of requiring certain categories of industries and municipalities to meet pollution discharge standards based on specific technology objectives regardless of the prior conditions or desired uses of the water. This policy change is examined in four ways: (1) the design of a conceptual approach to provide quantitative information based on available information; (2) use of the tools of quantitative analysis to examine both current policies and some logical alternatives; (3) analysis of the quantitative results to generate findings and conclusions; and (4) consideration of the findings and conclusions to gain insights into potential alternatives that are both more efficient than current policies and more feasibly implemented. Specific recommendations for changes in federal water pollution legislation are presented. (Coffey-Florida)
W79-08468

IMPLEMENTATION OF EXECUTIVE ORDERS 11988 (FLOODPLAIN MANAGEMENT) AND 11990 (PROTECTION OF WETLANDS),
International Boundary and Water Commission, El Paso, TX.
F. P. Fullerton.
Federal Register, Vol. 43, No. 136, p 30494-30495, Friday, July 14, 1978.

Descriptors: *Flood plains, *Wetlands, *Protection, *Legal aspects, United States.

The proposed procedures prescribes policies utilized or to be utilized by the United States Section, International Boundary and Water Commission, in implementing Executive Orders 11988 and 11990 as they pertain to the planning, design and construction of treaty projects along the United States-Mexican boundary and to the United States Section's operation and maintenance activities. (Stihler-Mass)
W79-08498

6F. Nonstructural Alternatives

FLOOD STUDIES LED TO NATIONAL FLOOD INSURANCE,
Geological Survey, Reston, VA. Water Resources Div.
G. W. Edelen, Jr., G. E. Ferguson, and W. B. Langbein.
Civil Engineering-ASCE, p 89-91, February 1979. 2 fig.

Descriptors: *Flood plains, *Flood plain zoning, *Flood plain insurance, Flood protection, Historic floods, Flood data, *Flood plan regulations, *Flood plain management, Federal Flood Insurance Act of 1956, Flood Protection Act of 1973.

The role of flood data in shaping the policies leading to the present flood-insurance program is outlined. Continued improvement in the range of flood information since the U.S. Geological Survey documented the occurrence and progress of the Passaic, New Jersey, flood in 1902 has been the essential key to changing public policy in efforts to cope with the ever increasing flood hazard. Initially, historic records of the magnitude of floods enabled engineers to design and construct works for flood protection. Longer flood records from an expanded network of streamflow stations provided a data base on which to develop flood-frequency relations and to identify an upper limit to actual flood experience. During the 1950's, a new approach centered on adapting flood-prone land use to the flood hazard. Flood-plain regulations became nonstructural alternatives to flood control works. Geological Survey engineers established that streamflow records were adequate and hydrologic techniques were sufficiently developed to provide a base for sound analysis of flood insurance risks. The Flood Protection Act of 1973 increased the limits of flood-insurance coverage and provided for speedier definition of flood-risk zones. (Woodard-USGS)
W79-08199

LESSONS FROM A WET STATE,
Conservation Law Foundation of New England, Inc., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-08402

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX E--FLOOD CONTROL.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 757, Price codes: A09 in paper copy, A01 in microfiche. Chaired by the U.S. Corps of Engineers, 1969, 140 p, 2 addenda, 18 tab, 15 fig, 9 maps, 26 photos.

Descriptors: *Flood control, *Non-structural alternatives, *Flood damage, *Flood protection, *River basin development, *Willamette River(OR), *Structural alternatives, Oregon, Water resources, Abatement, Channel improvement, Design flood, Flood forecasting, Flood plains, Construction, Floodproofing, Levees, Channel improvement, Warning systems, Flood storage reduction, Watershed management, Water policy, Flood plain zoning, Regulation, River basins, Management, Flood plain management.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix E - one of the functional appendices - is based on data contained in the three supporting Appendices, A through C. Its purpose is to outline action that might be taken to ameliorate increasing flood damages due to continuing development in the Basin. The present status of the Basin's flood problems is assessed by studying flood characteristics, flood areas, and flood damages. Ongoing flood damage programs, both structural and non-structural, are reviewed. Future demands are outlined through a presentation of projected flood plain development. Projected damage reductions are discussed. Future problems are inventoried; these include shortages of suitable dam sites, use conflict, levees, local cooperation, regulation of flood plain use, flood forecasting, and evacuation of flood control storage. Alternatives are presented for each of 11 subbasins. Both structural and non-structural measures are studied. The study concludes that flood damage reduction can be achieved, both by providing for such structural measures as flood control storage, levees, and channel stabilization and improvement; and by providing for non-structural measures, such as improved watershed management, flood plain regulation, and flood forecasting. Two addenda present potential flood control storage sites in the Basin and projected potential flood damages and damage-reduction benefits. (See also W79-08433) (Zayac-NC)
W79-08438

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX K--RECREATION,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 6B.
W79-08444

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL REQUIREMENTS AND POLLUTION TOLERANCE OF TRICHOPTERA,
Purdue Univ., Lafayette, IN. Dept. of Entomology.
T. L. Harris, and T. M. Lawrence.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 321, Price codes: A14 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-063, November 1978. 316 p, 1 fig, 245 tab, 289 ref. R803319.

Descriptors: *Aquatic insects, *Caddisflies, *Aquatic habitats, *Aquatic environment, Biology, Diet, Life cycles, Larvae, Distribution, Distribution patterns, Alkalinity, Nitrates, Temperature, Ammonia, Phosphorus, Nitrites, Toxicity, Heavy metals, Bioindicators.

Profiles for 245 taxa of North American Trichoptera are compiled from available information to serve in evaluating data collected for the assessment of water quality. The profiles include the following parameters: life stage, general habitat, specific habitat, retreat, diet, turbidity, current, temperature, pH, dissolved oxygen, alkalinity, nitrates, nitrites, ammonia, phosphorus (ortho and total), seasonal distribution, and geographical distribution. The ranges for these parameters are given where possible. When available, parameters such as toxic compounds, heavy metals, and pesticides are included. (Davison-IPA)
W79-08156

PROBABLE WALLEYE (STILOSTEDION VITREUM) HABITATION IN THE SNAKE RIVER AND TRIBUTARIES OF IDAHO,
Idaho Univ., Moscow. Water Resources Research Inst.
D. H. Bennett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 983, Price codes: A04 in paper copy, A01 in microfiche. Research Technical Completion Report, April 1979. 48 p, 4 fig, 1 tab, 70 ref. OWRT A-060-IDA(1). 14-34-0001-8014.

Descriptors: *Walleye, *Fish behavior, *Fish diets, *Fish migration, *Fish populations, Ecological distribution, Lentic environment, Lotic environment, Snake River(Idaho), Columbia River(Washington), Publications.

The walleye, an important sport and commercial fish species in Eastern and Central North America, is well known throughout its native and introduced range as a voracious predator inhibiting lentic and lotic ecosystems. Extensive drainage systems in the Pacific Northwest create an opportunity for wide distribution within a watershed when introductions are made. The presence of walleye in the Lower Snake River has aroused concern over possible expansion of its populations into the upper Snake, Clearwater and Salmon river systems which have historically produced large runs of anadromous fishes. Walleye could intensify predation on emigrating juvenile salmonids, further contribution to the decline of anadromous fish in Idaho. The historic impact of walleye on salmonid fishes is reviewed. Data on the occurrence and abundance of walleye in the Snake and Columbia rivers is documented. Literature on the walleye is plentiful in published and unpublished sources, and a bibliography containing 107 listings is provided. (Davison-IPA)
W79-08167

INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE,
Construction Engineering Research Lab., Champaign, IL.
R. E. Riggins, and J. R. Anderson.
Prepared for Goddard Space Flight Center, Greenbelt, MD, May 1977. 38 p, 18 fig, 2 append, 10 tab. S-53875.

Descriptors: *Reservoir construction, *Water sources, *Reservoir stages, *Reservoir silting, *Salt River(MO), *Missouri, *Clarence Cannon Dam(MO), Land use, Regional planning, Ecology, Environmental effects, Remote sensing, Aerial photography, Vegetation effects(Cover), Satellites, Landsat imagery, Aircraft imagery.

The purpose of this report is to develop a preproject environmental baseline so that environmental changes that occur during construction and operation of an inland reservoir can be identified. This project is the second of a series of investigations designed to measure changes in the ecology of a river basin using high-altitude aerial and satellite imagery. The project is the Clarence Cannon Dam and Reservoir located on the Salt River in northeastern Missouri, Multi-seasonal landsat images were used to record preproject environmental conditions, especially land cover characteristics. The report presents landsat images of the land cover at various stages of the year using alternative processing methods. The grid-cell mapping and dual-image mapping techniques are described and the results of each technique in accurately determining land cover are presented. Aircraft imagery was obtained during this study for use in analyzing the project area and then comparing its usefulness with landsat imagery. Two levels of analysis were pursued; a regional scale analysis, and a more detailed study analysis. Both levels are described and illustrated to show how the aircraft imagery can be used for environmental monitoring and establishment of baseline information. The anticipated physical and biological impacts of an inland reservoir are summarized. (Coan-NC)
W79-08179

STRATEGIES FOR RESERVING FLOWS FOR FISH AND WILDLIFE; IDENTIFICATION, DESCRIPTION, AND PRELIMINARY EVALUATION,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6E.
W79-08401

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
For primary bibliographic entry see Field 6E.
W79-08418

EFFECTS OF VARIOUS IRRIGATION SCHEDULES ON POPULATION DENSITIES OF BANKS GRASS MITE AND ITS PREDATORY ARTHROPODS IN CORN, THE TEXAS HIGH PLAINS,
Texas Agricultural Experiment Station, College Station.
L. D. Chandler, C. R. Ward, W. M. Lyle, and E. D. Dynum.
Report No. PR 3443 C, April 1977, 17 p, 6 tab, 16 ref.

Descriptors: *Insect control, *Scheduling, *Mites, *Irrigation effects, *Irrigation practices, *Crop response, Pest control, Integrated control measures, Environmental effects, Arthropods, Crop production, Corn, Sorghum, Soil moisture, Texas High Plains.

Since its first major outbreak in 1967, the Banks grass mite (Oligonychus pratensis) has become a major problem to corn and sorghum producers on the Texas High Plains. Apparently favoring the dry hot climatic conditions of this area, mite populations have shown high mortality in the past due to prolonged rainfall, so specified irrigation rates in conjunction with seasonal climatic conditions have been suggested as possible methods of control. Considering this possibility of non-chemical control methods, the present corn irrigation study, using different irrigation treatments, was initiated during the 1976 growing season at the Texas A & M Agricultural Research Station at Halfway. Pioneer 3369-A hybrid corn was planted April 20 at a rate of 32,000 plants per acre and eight row-irrigation treatments with three replicates were arranged in randomized block statistical design. Threatments tested included: (1) an alternate row irrigation on a 1-2 week schedule, (2) an every row irrigation on a 3-4 week schedule, (3) an alternate irrigation using the same schedule as treatment 2, and treatments 4-8) consisted of scheduled irrigation rates based on available soil moisture. Mite populations were sampled weekly beginning June 29 from the center 2 rows of each plot and classified by number of females and other beneficial arthropods. Results indicated (1) the use of irrigation scheduling can be effective as a mite control method, (2) soil moisture measuremnts can be a good indicator of needed irrigation at different plant stages, and (3) irrigation coupled with seasonal rainfall and predators can adequately check mite increases. (Tickes-Arizona)
W79-08422

THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: MAIN REPORT,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4A.
W79-08433

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX A--STUDY AREA.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4C.
W79-08434

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX B--HYDROLOGY,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 2A.
W79-08435

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX D-- FISH AND WILDLIFE,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 8I.
W79-08437

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX G- LAND MEASURES AND WATERSHED PROTECTION.
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
For primary bibliographic entry see Field 4D.
W79-08440

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

MANAGEMENT OF WETLANDS FOR WILDLIFE HABITAT IMPROVEMENT,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
For primary bibliographic entry see Field 2I.
W79-08470

RIVER PLANTS; THE MACROPHYTIC VEGETATION OF WATERCOURSES,
Cambridge Univ. (England). Botany School.
For primary bibliographic entry see Field 2I.
W79-08482

THE NATURAL ENVIRONMENTS OF GEORGIA,

Georgia State Univ., Atlanta.
For primary bibliographic entry see Field 2I.
W79-08484

THE ENVIRONMENTAL IMPACT OF AGRICULTURE IN ETHIOPIA,
Helsinki Univ. (Finalnd).
A. Kuru.
Environmental Conservation, Vol. 5, No. 3, p 213-220, Autumn 1978, 3 fig, 2 tab, 6 ref.

Descriptors: *Environmental effects, *Environmental control, *Erosion, *Limiting factors, *Comprehensive planning, Ecosystems, Agroclimatology, Crop response, Productivity, Vegetation effects, Social aspects, Water resources development, Arid lands, Ethiopia, Livestock, Water supply, Water shortage.

Agriculture in Ethiopia where a wide range of climatic conditions give rise to a great variety in natural vegetation types, ranging from luxuriant tropical mountain forests to absolute desert, is dependent upon water, the decisive and chief limiting factor in the growing of crops and raising of animals. This comprehensive analysis of Ethiopia's agricultural sector and its environmental impacts reveals that the country as a whole is constrained by interrelated human and ecological problems consisting of insufficient development plans, lack of protection of its resources, poor transport and communication facilities, inadequate education and an absence of technically trained manpower. These problems, their effects and possible means of improvement are elucidated by this author with emphasis upon an ecosystem approach in which actions in one area are viewed in the historical terms of the entire system. Examples include a description of the short rainy season in the arid regions where fluctuations in precipitation restrict the usefulness of pastures to a very short period of the year. Water is thus the limiting factor when herds travel long distance to drinking water which only depresses the quality of the cattle as well as increasing the hazard of erosion associated with such movements. These severe erosion problems exacerbate the constraints in the distribution and quality of water available for domestic supplies, livestock, and crops. (Tickes-Arizona)
W79-08487

WETLANDS, DRAINAGE AND LEISURE,
E. W. Dash.
Parks and Recreation (London), Vol. 42, No. 6, p 64-66, June, 1977.

Descriptors: *Wetlands, *Europe, *Conservation, Marsh management, Drainage, Productivity, Fishing.

Once thought of as monotonous expanses of wasteland fit only for reclamation and development, wetlands now not only provide many people with relief from everyday life, but also offer a wide range of active pursuits to farmers, hunters, fishermen, naturalists and tourists. These uses and the potential threats to the rest of the European wetlands made the Council for Europe's Center for Nature Conservation dedicate the year 1976 to the conservation and management of wetlands. (Steiner-Mass)
W79-08489

7. RESOURCES DATA

7A. Network Design

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

7B. Data Acquisition

AN INEXPENSIVE TENSIOMETER FOR SNOW-MELT RESEARCH,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W79-08114

A STUDY OF SEVERAL PRESSURE RIDGES AND ICE ISLANDS IN THE CANADIAN BEAUFORT SEA,
Gulf Oil Canada Ltd., Calgary (Alberta).
For primary bibliographic entry see Field 2C.
W79-08121

CALCULATION OF EVAPORATION DURING THE THREE STAGES OF SOIL DRYING,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2D.
W79-08138

ELECTROLYTIC METHOD FOR MEASURING FLOW VELOCITY,
N. V. Pikush.
Soviet Hydrology: Selected Papers, Vol. 16, No. 3, p 254-255, 1977. 3 fig, 2 ref. Translated from Hydraulic Engineering and Reclamation (Gidrotekhnika i melioratatsiya) No. 5, p 51-53, 1977.

Descriptors: *Flow measurement, *Methodology, *Instrumentation, *Flowmeters, Velocity, Testing procedures, Average flow, Measurement, Canals, Channels, Electrolytes, Sodium chloride, Conductivity, Ions, Current meters, Electrodes, Salt velocity method.

The electrolytic method examined is simple and very accurate. It can be applied only in straight reaches of canals and channels of the same form, where water movement is uniform. The method consists of simultaneously introducing an electrolyte into the flow and measuring the variations in the electrical conductivity of the water in the flow at two gaging stations lying downstream. The first experimental measurements of average flow velocity by the electrolyic method were performed in the main canal of the Trubezh irrigation system at Baryshevka village. The average velocity determined by this method from the peak of electrical conductivity and the center of the cloud was found to vary from 0.0344 to 0.035 m/sec in two experiments, while that obtained as the ratio of the discharge taken from the discharge curve to the cross section area of the water was found to be 0.035 m/sec. Subsequently, numerous measurements made in various canals and rivers confirmed the high accuracy of the proposed method. It is particularly advisable to use the electrolytic method where current meters are unusable for various reasons. (Humphreys-ISWS)
W79-08144

INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE,
Construction Engineering Research Lab., Champaign, IL.
For primary bibliographic entry see Field 6G.
W79-08179

GROUNDWATER SOURCES LOCATED BY FRACTURE TRACE TECHNIQUE,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 2G.
W79-08338

TENSIOMETERS AND IRRIGATION SCHEDULING,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
For primary bibliographic entry see Field 4B.
W79-08362

BENTHIC DETRITUS IN A SALTMARSH TIDAL CREEK,
Virginia Univ., Charlottesville. Dept. of Environmental Studies.
For primary bibliographic entry see Field 2I.
W79-08478

REMOTE SENSING OF COASTAL WETLAND VEGETATION AND ESTUARINE WATER PROPERTIES,
Delaware Univ., Newark. Coll. of Marine Studies.
V. Klemas.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary. M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 381-403. 11 fig, 2 tab, 53 ref.

Descriptors: *Remote sensing, *Wetlands, *Estuaries, Coasts, Vegetation, Pollutants, Currents(Water), Suspended solids, Satellite(Artificial), Maps.

Photo-interpretation of aircraft and satellite imagery with the aid of 'ground truth' is illustrated employing both direct visual and automated computer techniques. Specific applications include mapping wetland vegetation and coastal land use, monitoring natural and man-induced changes in the coastal zone, charting current circulation and determining the type and concentration of suspended matter in coastal waters. Imaging suspended matter or other subsurface features is more difficult than mapping surface slicks or land use because of complex mixing, scattering and absorption processes in the water column. For some applications, it is shown that an integrated boat-aircraft-satellite approach can produce better results or cast less than the deployment of large numbers of boats or field teams without remote sensor support. (Stihler-Mass)
W79-08481

7C. Evaluation, Processing and Publication

SIX-MINUTE RAINFALL INTENSITY DATA FOR AN EXCEPTIONALLY HEAVY TROPICAL RAINSTORM,
Queensland Dept. of Forestry, Atherton (Australia).
For primary bibliographic entry see Field 2B.
W79-08123

INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE,
Construction Engineering Research Lab., Champaign, IL.
For primary bibliographic entry see Field 6G.
W79-08179

PREDICTION OF DRAINAGE DENSITY FROM SURROGATE MEASURES,
Hull Univ. (England). Dept. of Geography.
K. S. Richards.
Water Resources Research, Vol. 15, No. 2, p 435-442, April 1979. 7 fig, 5 tab, 22 ref.

Descriptors: *Drainage density, *Watersheds(Basins), *Measurement, Geomorphology, Geology, Maps, Channels, Analysis, Equations, Sampling, *Surrogate measures, Surrogate indices, Line-sampling methods, Shreve segments.

A number of surrogate indices have been proposed as alternatives to, or predictors of, drainage density. These involve quadrat- and line-sampling methods, which avoid the problems of watershed definition and irregular area measurement, and counts of segments, junctions, and sources, which avoid measurement of irregular line lengths. These techniques were evaluated, and the number of Shreve segments within a quadrat-sampling unit was found to be consistently the best predictor of both quadrat and basin drainage density, although differences occur according to the nature of network definition (blue line or contour crenulated). A number of tests of the suggested prediction relationships were described, and these indicated that the method can successfully predict drainage densities in areas other than the area for which the

relationship is derived and on different map editions at the same scale. (Lee-ISWS)
W79-08265

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, VOLUME 1, PART I -- IV,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W79-08271

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART V: PERSPECTIVES AND TOOLS FOR COPING WITH SOCIOTECHNICAL ENGINEERING SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W79-08272

A SCREENING MODEL FOR PLAN FORMULATION IN SOUTHEASTERN NEW ENGLAND, PART VI: LAND USE CAPABILITY MAPPING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W79-08273

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN COLORADO--FISCAL YEAR 1979,
Geological Survey, Lakewood, CO. Water Resources Div.
D. E. Hillier.
Geological Survey open-file report 79-402, March 1979. 101 p, 33 fig, 1 plate, 1 tab.

Descriptors: *Water resources, *Colorado, *Surface waters, *Groundwater, *Water quality, Basic data collection, Projects, Maps, Colorado River basin, Missouri River basin, Arkansas River basin, Rio Grande basin.

Water-resources data-collection activities for October 1, 1978, through September 30, 1979, are summarized for Colorado and bordering States. Forty-nine interpretive hydrologic investigations include: 6 statewide investigations, 5 regional investigations, 10 investigations in the Missouri River basin, 8 investigations in the Arkansas River basin, 3 investigations in the Rio Grande basin, 15 investigations in the Colorado River basin, and 2 multistate investigations. The summaries of the investigations consist of maps showing the location of the areas of investigations and a brief description of the investigation's purpose, objective, approach, progress, and plans. (Woodard-USGS)
W79-08382

WATER RESOURCES DATA FOR MISSOURI, WATER YEAR 1977,
Geological Survey, Rolla, MO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 604, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MO-77-1, August 1978. 277 p, 3 fig.

Descriptors: *Missouri, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water quality of ground water. This report contains discharge records for 122 gaging stations; stage records for 3 of these gaging stations; contents for 6 lakes and reservoirs; and water quality for 21 gaging stations, 11 partial-record stations, 1 lake and 3 wells. Also included are data for 99 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Missouri. (Woodard-USGS)
W79-08383

WATER RESOURCES DATA FOR PUERTO RICO, SURFACE AND QUALITY-OF-WATER RECORDS, WATER YEARS 1975-76, GROUND WATER RECORDS, WATER YEARS 1973-76,
Geological Survey, Ft. Buchanan, PR. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 415, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report PR-76-1, December 1978. 366 p, 19 fig, 3 tab. 25 ref.

Descriptors: *Puerto Rico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for surface water and quality-of-water-records for 1975-76 water years and ground water for 1973-76 water years for Puerto Rico consist of records of stream discharge, water quality of streams, and water levels of wells. This report contains discharge and water-quality records for 34 gaging stations, 86 water-quality stations, and 47 miscellaneous water-quality stations; and water levels for 50 observation wells. Also included are data for 16 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and the National Water Data System operated by the U.S. Geological Survey and the Commonwealth of Puerto Rico. (Woodard-USGS)
W79-08390

HYDROGEOLOGIC FEATURES OF THE ALLUVIAL DEPOSITS IN THE GREYBULL RIVER VALLEY, BIGHORN BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley, and W. J. Head.
Geological Survey Water-Resources Investigations 79-6 (open-file report), 1979. 38 p, 3 fig, 2 plates, 7 tab, 13 ref.

Descriptors: *Groundwater resources, *Wyoming, *Aquifer characteristics, *Water yield, *Water quality, Water wells, Alluvial aquifers, Hydrogeology, Surface-groundwater relationships, Rocky Mountain region, Streamflow, Water yield, Groundwater recharge, Flood plains, Irrigation, Chemical analysis, Maps, *Bighorn Basin(WY), *Greybull River Valley(WY).

The alluvial aquifer along the Greybull River in Wyoming, consists principally of the Greybull terrace doposits and flood-plain alluvium but also includes Burlington terrace deposits east of Burlington, the McKinnie terrace, and the younger, generally undissected alluvial-fan deposits. Well-log data and 18 surface-resistivity measurements at four localities indicate that the thickness of the alluvial aquifer is as much as 60 feet thick only near Burlington and Otto. The most favorable area for development of ground water from the alluvial aquifer is near Burlington and Otto where relatively large amounts of water can be obtained from the Greybull terrace deposits and the flood-plain alluvium. Elsewhere, the deposits of the alluvial aquifer yield only small amounts of water to wells. (Woodard-USGS)
W79-08391

WATER RESOURCES OF THE NORTHERN UINTA BASIN AREA, UTAH AND COLORADO, WITH SPECIAL EMPHASIS ON GROUND-WATER SUPPLY,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. W. Hood, and F. K. Fields.
Utah Department of Natural Resources Technical Publication No. 62, 1978. 75 p, 20 fig, 5 plates, 9 tab, 44 ref.

Descriptors: *Groundwater resources, *Surface-groundwater relationships, *Aquifer characteristics, *Available water, *Water quality, River basins, Water wells, Withdrawal, Water yield, Water supply, Water utilization, Surface waters, Flow rates, Maps, Utah, Colorado, *Uinta Basin area.

During 1971-74, hydrologic studies were made in a 5,200 square-mile area of the Unita Basin and Uinta Mountains. The principal sources of water are precipitation and trans-basin inflow through the Green and White Rivers, which for the period 1941-70 annually averaged 4.87 million acre-feet and 3.55 million acre-feet, respectively. Of the water from precipitation within the area, 190,000 acre-feet was exported annually and 440,000 acre-feet entered the Green River. The ground-water system is in unconsolidated and consolidated rocks. Gross recharge is estimated to be 500,000 acre-feet, of which 200,000 acre-feet returns to streams in the upland areas. Withdrawals by man have not changed the amount of ground water in storage significantly. Fresh to slightly saline water in storage amounts to an estimated 28 million acre-feet. Approximately 160,000 acre-feet is consumed by evapotranspiration, 12,000 acre-feet is consumed by man, and 128,000 acre-feet is discharged to streams. During high flow, all streams are fresh; during low flow, water at the mouths of some tributaries is slightly to moderately saline. Ground water ranges from fresh to briny. Fresh to slightly saline water can be obtained from at least one aquifer in about two-thirds of the area. (Woodard-USGS)
W79-08395

THE OLIGOCENE AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
L. A. Gandl.
Geological Survey Water-Resources Investigations 79-28 (open-file report), 1979. 2 sheets, 5 fig, 3 tab, 23 ref.

Descriptors: *Groundwater resources, *Mississippi, *Aquifer characteristics, *Water quality, *Water levels, Maps, Water wells, Water yield, Hydrogeology, Water analysis, Chemical analysis, Water utilization, *Oligocene aquifer system, Forest Hill Sand, Byram Formation, Mariana limestone, Vicksburg group.

The Oligocene aquifer system in Mississippi consists of limestone and marl members of the Vicksburg Group, and the underlying Forest Hill Sand. The aquifer system crops out in a band 5 to 10 miles wide, that trends southeast across the State from the Warren-Yazoo County line to northeastern Wayne County. In the northwest part of the area, the formations dip to the southwest at 12 feet per mile. At the southeastern end of the outcrop, the dip is 42 feet per mile. The average dip for the entire area is 30 feet per mile. The aquifers are of primary importance for domestic and farm use. Total withdrawal in 1977 was about 1.4 million gallons per day. Since 1963 water levels have declined an average of between 0.05 and 2 feet per year. Water quality is generally good although in some places there are objectionably high concentrations of iron and color. (Woodard-USGS)
W79-08399

PRINCIPLES FOR LOCAL ENVIRONMENTAL MANAGEMENT,
For primary bibliographic entry see Field 6E.
W79-08467

8. ENGINEERING WORKS

8A. Structures

DEVELOPMENT AND APPLICATION OF SEDIMENT BASINS IN MARYLAND,

Soil Conservation Service, College Park, MD.
For primary bibliographic entry see Field 2J.
W79-08006

PROTOTYPE SPILLWAY PERFORMANCE VERIFICATION,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 8B.
W79-08092

QUASISTATIC RESPONSE OF OFFSHORE STRUCTURES USING PROBABILISTIC METHODS,
Liverpool Univ. (England). Dept. of Civil Engineering.
R. Burrows.
Applied Mathematical Modelling, Vol. 1, No. 6, p 325-332, September 1977. 6 fig, 1 tab, 39 equ, 16 ref, 2 appen.

Descriptors: *Offshore structures, *Probability, *Wave loading, *Hydraulics, *Statistical methods, Mathematical models, Systems analysis, Equations, Design, Gaussian process, Morison's equation, Multivariate pdf, Linear structures, First-order wave theory, Quasistatic response.

Recent research has developed probabilistic descriptions of wave loading on short sections of offshore structure members subject to random wave loading. These descriptions include both short and long term distributions of loading and their peak and extreme values, a knowledge of which is required for the structural design of members. Unfortunately, such a single component of loading is inadequate to effectively model all but the simplest of structural members and an extension of the probabilistic techniques is required to describe structural response, such as stress or deformation, for systems of a large number of loading components. For structures not subject to high dynamic response, there is evidence that the quasistatic response variables are distributed with a similar form to the wave loading, which, in the short term and in the absence of uni-directional currents, is fully described by its second and fourth statistical moments. This paper derives expressions for these moments of the response variables which then enables a similar treatment of response as has been applied to the loading on short sections of structural members. A simple example of a possible application of the method is included. (Bell-Graf--Cornell)
W79-08208

MORE AND BETTER USES COULD BE MADE OF BILLIONS OF GALLONS OF WATER BY IMPROVING IRRIGATION DELIVERY SYSTEMS: DEPARTMENT OF AGRICULTURE AND THE INTERIOR,
Comptroller General of the United States, Washington, DC.
E. B. Staats.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 739, Price codes: A04 in paper copy, A01 in microfiche. Report to Congress No. CED-77-117, September 2, 1977. 52 p, 4 fig, 3 append.

Descriptors: *Water conservation, *Canal seepage, *Water loss, *Government finance, *Interagency cooperation, *Irrigation efficiency, *Irrigation, *Conveyance structures, Conduits, Concrete-lined canals, Governments, Irrigation programs, Water delivery, Water utilization, Bureau of Reclamation.

Opportunities to better administer the Federal programs providing funds for water conveyance system improvements are discussed. To conserve current supplies, seepage losses from irrigation conveyance systems should be reduced. Although reports and studies stressed the importance of the seepage problem and identified the potential benefits of water saved by improving conveyance systems, further analyses are needed to identify and determine the overall basinwide effects of system improvements and areas where additional Federal participation would promote the national interest. Throughout the West where the seepage problem exists, water is supplied by Federal projects to about one-fifth of the total irrigated land, so that cooperation between local, State, and Federal agencies is required to lessen seepage. Reasons demonstrating the need for such cooperation are cited. A program designed to facilitate this cooperation would include the following: improved accuracy of reported seepage data; consideration of overall basinwide effects of improving conveyance systems; and identification of and solutions to institutional and legal constraints hindering improvements to water conveyance systems. (Davison-IPA)
W79-08353

THE CONFLICT OVER THE NEW RIVER AND THE TEST CASE FOR THE WILD AND SCENIC RIVERS ACT (COMMENT ON NORTH CAROLINA V. FPC),
North Carolina Central Univ., Durham.
For primary bibliographic entry see Field 6E.
W79-08418

8B. Hydraulics

PROTOTYPE SPILLWAY PERFORMANCE VERIFICATION,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulic Lab.
C. L. Anderson, and F. W. Blaisdell.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14639, p 707-720, June 1979. 11 fig, 2 ref, 2 append.

Descriptors: *Spillways, *Hydraulic structures, *Inlets(Waterways), *Model studies, Hydraulic models, Flow, Hysteresis, Structures, Drops(Structures), On-site investigations, Simulation analysis, Hydraulics.

The flow performance of a prototype closed conduit spillway which could not be explained analytically was verified by a physical model. During the falling stage of the outflow from the reservoir, full conduit flow was observed in the Marsh Creek spillway, even though the pool level was below the spillway crest. Engineers inspecting the spillway could not explain the flow performance. A physical model of the prototype was built and tested to verify the prototype performance. Tested with open and closed air vents, the model demonstrated the hysteresis shown in the falling limb of the prototype head-discharge relationship and the siphon-regulated flow observed in the prototype. Model observations indicated that the prototype flow control problem is the result of inadequate venting of the covered-top drop inlet. (Sims-ISWS)
W79-08092

HYDRAULIC RESISTANCE OF ARTIFICIAL STRIP ROUGHNESS,
Birmingham Univ. (England). Dept. of Civil Engineering.
D. W. Knight, and J. A. Macdonald.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14635, p 675-690, June 1979. 10 fig, 1 tab, 19 ref, 2 append.

Descriptors: *Roughness(Hydraulic), *Flow resistance, *Laboratory tests, *Open channel flow, Model studies, Hydraulic models, Mathematical models, Turbulence, Flow, Boundary processes, Boundaries(Surfaces), Hydraulics, Shear, Reynolds number, Roughness coefficient, Fluid friction, Fluid mechanics, Boundary shear.

An experimental study of two-dimensional flow over non-uniform roughness was reported in which artificial strip roughness was employed. The roughness elements were square in cross section and placed at different relative spacings. A six-fold classification system was suggested based upon the ideas of Morris and Adachi. Resistance data from other investigators also were considered, and the variation of resistance coefficient with Reynolds number, relative spacing, and relative depth were examined. The general resistance parameter, X, first introduced by Sayre and Albertson was found to be particularly helpful in synthesizing the various sets of resistance data. Logarithmic resistance equations involving X were validated over a wide range of roughness wavelength to height ratio. The relationship between roughness height and Nikuradse's equivalent sand roughness size was also examined. (Sims-ISWS)
W79-08093

A PROBABILISTIC MODEL FOR A RANDOMLY EXCITED FLOW,
Cairo Univ., Giza (Egypt). Dept. of Mechanical Engineering.
Y. K. Gayed, M. R. Haddara, and A. H. A. Baghdadi.
Applied Mathematical Modelling, Vol. 1, No. 6, p 299-309, September 1977. 9 fig, 1 tab, 66 equ, 11 ref, 2 append.

Descriptors: *Probability, *Mathematical models, *Hydroelectric plants, *Surge tanks, *Unsteady flow, *Stationary response, *Extreme values, Load variation, Gate valve opening, Stochastic signal, Penstocks, Pipes, Conservation equations, Euler equation of motion, Continuity equation, Systems analysis, *Hydraulics.

The deterministic approach to the construction of mathematical models for solving the problem of load fluctuation in hydro-electric power plants has been the subject of considerable investigation. Means of mitigating adverse effects, by use of surge tanks or otherwise, has received equal attention. In fact, the load demand on an electric power plant is never regular; consequently load variation may be subject to random effects. The present work concerns a probabilistic model of the random problem, whose solution gives the distribution and probability density functions of the variables involved, namely the pressures, velocities and surge tank oscillation. Order statistical methods were also used to estimate the probability of occurrence of extreme head fluctuations. (Bell-Graf--Cornell)
W79-08207

8C. Hydraulic Machinery

UPSURGE AND SPEED-RISE CHARTS DUE TO PUMP SHUTDOWN,
Donsky Engineering Co., Denver, CO.
B. Donsky, R. M. Byrne, and P. E. Bartlett.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY6, Proceedings Paper 14637, p 661-674, June 1979. 11 fig, 6 ref, 2 append.

Descriptors: *Centrifugal pumps, *Unsteady flow, *Pipe flow, *Design criteria, Hydraulic machinery, Pumps, Water hammer, Discharge lines, Analytical techniques, Mathematical models, Theoretical analysis, Hydraulics, Flow, Flow characteristics, Fluid friction, Fluid mechanics, Discharge lines, Pump speed changes, Power shutdown, Pump characteristics.

Radial (centrifugal) pumps can limit and reduce the reverse flow as the pump speeds up in reverse after power shutdown. This may cause head rises at the pump and along the discharge line. Usually, the amplitude of these upsurges with either an increase in 2 rho, or with an increase in K(2L/a) for a constant 2 rho, in which rho = the pipeline characteristic parameter: 2L/a = the round trip wave travel time; and K is a pump constant. This paper presented results of an analytical study that show that both the maximum reverse speed rise and the maximum head rise at the pump increase with an increase in K(2L/a) up to some value of K(2L/a) for each 2 rho. However, as K(2L/a) increases beyond this value, both the maximum head rise and speed rise decrease. In addition, the effect of friction on head changes in the line was presented. The results were presented in the form of charts that can be used to assist in the design of pump discharge systems providing there has been no fluid column separation. (Humphreys-ISWS)
W79-08091

FLOW CONTROL ALGORITHMS FOR YUMA DESALTING PLANT,
Bureau of Reclamation, Denver, CO. Electric Power Branch.
S. C. Stitt.
Report No. REC-ERC-78-11. December 1978. 39 p, 16 fig, 1 tab, 3 ref.

Descriptors: *Flow control, *Computer programs, *Algorithms, Digital computers, Valves, Automatic control, Desalination apparatus, Water treatment, Pre-treatment(Water), Proportional-integral-derivative(PID), Yuma(Arizona).

A programmable master supervisory control system is proposed for the Yuma Desalting Plant. Required control and data acquisition functions will be performed through minicomputer remotes. There are three requirements for the basic control function which is the flow control system: the algorithm monitors valve flow only, the valve motors will be fixed-speed motors, and the algorithm must be a general one, adaptable to different valve characteristics and travel times. Two algorithms were developed; they are discussed and contrasted. The simpler proportion control algorithm (proportional-integral-derivative, or PID) takes up less memory to implement, but does not easily accommodate the nonlinearities of the valve. The predictor/corrector algorithm can account for some nonlinearities; also, it cuts down on the pulsing of the motor, which the PID relies on to obtain slower motor speeds. The PID algorithm would work well in flow control situations where constant head changes are taking place and relatively few set-point changes occur. The predictor/corrector is desirable in situations where there are few head changes; the added accuracy, efficiency, and adaptability afforded by it are worth the additional complexity of the algorithm. Included are flow charts, and definitions of timing and interface requirements. (Schaefer-IPA)
W79-08356

8D. Soil Mechanics

PUMP OUT TEST IN ALLUVIAL SANDS,
Central Building Research Inst., Roorkee (India).
A. Singh, G. S. Jain, and V. S. Aggarwal.
Transactions of Indian Society of Desert Technology and University Centre of Desert Studies, Vol. 2, No. 2, p 171-176, Dec 1977, 7 fig, 2 tab, 4 ref.

Descriptors: *Permeability, *Sands, *Aquifer characteristics, *Soil physical properties, *Alluvium, *Pumping, *Groundwater movement, Soil horizons, Stratification, Piezometers, Water table, Correlation analysis, Clays, India, Testing procedures.

Presented here is an account of a pump out test conducted to determine the in-situ permeability of alluvial sands for designing a dewatering scheme at the site of the atomic power plant at Narora, India. Borings up to a depth of about 60 M at the site which is situated on the right bank of the Ganga River about 5 KM down stream from the Narora Barrage indicated a predominately sandy deposit with layers of clayey soil at two different depths. These layers were interspersed with sand layers, and the groundwater table, located about 10 M below ground level, was observed to fluctuate only within a range of about 1.75 M. A fully or partially penetrating well and a number of piezometers were arranged on 3 tiers preferably 120 degrees to each other. Water levels were recorded after every hour with a simple electrical dip gauge. A similar technique was used to measure the water table in each of the 14 piezometers, and well discharge was measured for each determination of water table position. Results indicated that the coefficient of permeability as determined by these field tests agreed closely with empirical correlations for poorly graded uniform sands although empirical correlation with well graded sand deposits was found to give unreliable values. It is suggested that field tests can be minimized in number on poorly graded uniform sands. (Tickes-Arizona)
W79-08027

8E. Rock Mechanics and Geology

DETERMINATION OF THE BASEMENT COMPLEX CONFIGURATION IN THE SAFFORD VALLEY, ARIZONA, BY BOUGUER GRAVITY ANOMALY TECHNIQUES,
Paris-6 Univ. (France). Lab. de Geologie Dynamique.
A. B. Muller.
Journal of the Arizona Nevada Academy of Science, Vol. 13, No. 1, p 3-6, Feb. 1978, 2 fig, 7 ref.

Descriptors: *Geological surveys, *Gravimetric analyses, *Bouguer Gravity Anomaly techniques, *Geologic formations, Geologic investigations, On-site investigations, Geologic mapping, Geomorphology, Geophysics, Data collection, Safford Valley, Wells, Bedrock, Arizona.

Described is the determination of the basement complex configuration of the Safford Valley in Graham County, Arizona, by indirect geophysical techniques of gravimetry and gravimetric interpretation to better understand the vertical extent of fill material in this valley. The Safford Valley, approximately 30 miles long and an average 12 miles wide, runs along the Gila River, its only perennial water course. Actual depth to valley fill bedrock interface is not generally known, since few wells along the margins of the valley have intercepted the interface, and wells as deep as 3767 feet have not reached bedrock. Gravimetric data collected by students in the summer of 1972 and supplemented by USGS data were reduced to reflect actual gravitation and plotted and contoured for 214 selected stations on a Bouguer Gravity Anomaly Map. A computer model used to determine the actual configuration and depth to basement complex indicated that the underlying complex of the Safford Valley roughly conforms in slope to the non-burred portions of the complex. The gentle slope of the Gila Mountains and the relatively steep slope of the Pinaleno Mountains toward the axis of the valley intersect along a trough on the southern side of the western limb of the valley. This trough, probably reaching depths of 5200 ft., does not propagate into the eastern limb where the basement complex dips primarily along the axis of the minor limb in the direction of the northern side of the complex in the major limb. The underlying structure does not appear to conform to the bend in the river and the Safford Valley appears to be a deep block faulted structural trough forming a repository for extensive detrital fill. (Tickes-Arizona)
W79-08369

IMPACT OF CLIMATIC CHANGE ON AN ARID WATERSHED: NAHAL YAEL, SOUTHERN ISRAEL,
Arizona Univ., Tucson. Dept. of Geosciences; and Hebrew Univ., Jerusalem (Israel). Dept. of Geography.
W. B. Bull, and A. P. Schick.
Quaternary Research, Vol. 11, p 153-171, 1979, 12 fig, 3 tab, 18 ref.

Descriptors: *Geohydrologic units, *Hydrogeology, *Geomorphology, Geologic history, *Dating, *History, *Geologic time, Geologic formations, Slopes, Fluvial sediments, Pleistocene epoch, Geophysics, Israel, Deserts, Recent epoch, Colluvium, Sediment transport.

To assess the impact of climatic change on the geomorphic processes of an extremely arid fluvial system, data from the Nahal Yael drainage basin and adjacent small Nahel Naomi in the southern Negev and Sinai were examined. Observations of precipitation, streamflow, erosion and deposition in the area have been made over the last decade. The climatic geomorphology shows that thin grassy colluvium, once covering the lower portions of the granite hillslopes in the late Pleistocene, is now completely stripped, causing marked contrasts in outcrop morphologies. Previously mantled slopes are now smooth and crumbly, lacking desert varnish, while previously unmantled slopes are rough, craggy, and varnished, but little weathered. This suggests a change from semiarid to a drier and/or warmer climate. Responding to climatically-induced changes in water discharge and hill-slope sediment, the stream subsystem experienced increased sediment yields, producing valley alluviation in the early Holocene, and a decrease in sediment yield later, causing entrenchment of the valley fill. More granite and amphibolite gravel-size particles are presently transported than when the hillslopes were extensively mantled, and dense networks of trails, uncommon in Holocene geomorphic surfaces, are present in remnants of Pleistocene surfaces. (Tickes-Arizona)
W79-08373

8I. Fisheries Engineering

EGG DEPOSITION OF THE DESERT PUPFISH, CYPRINODON MACULARIUS, IN RELATION TO SEVERAL PHYSICAL PARAMETERS,
California State Dept. of Fish and Game, Rancho Cordova; and California Univ., Davis. Div. of Wildlife and Fisheries Biology.
L. A. Courtois, and S. Hino.
California Fish and Game, Vol. 65, No. 2, p 100-105, 1979, 2 tab, 1 fig, 9 ref.

Descriptors: *Fish eggs, *Fish behavior, *Fish conservation, *Fish management, *Desert pupfish, *Endangered species, *Aquatic environment, *Fish reproduction, Aquatic productivity, Environmental effects, Spawning, Salinity, Depth, California wildlife conservation.

Although various aspects of artificial propagation of the Desert Pupfish (Cyrinodon macularius) have been extensively studied, egg production has been limited in all of these studies because pairs of pupfish (one male and one female) were used in each tank. The present study examines reproduction of groups of pupfish, rather than pairs in relation to color of spawning substrate, salinity, and water depth. Fish used for experimentation were collected from canals around the Salton Sea, California, during January 1975, transported to the laboratory and subjected to various experiments designed to provide further understanding of environmental influences on the reproductive biology of this species. Results indicated that fish acclimated to 50/00 salinity deposited more eggs, usually in the deepest portion (37 cm) of their tank than fish acclimated to 150/00 salinity who utilized the intermediate depth (22 cm) of their tank for deposition significantly more than other available depths, color preference studies indicated that green spawning mops were more frequently used than gray, green or beige. (Tickes-Arizona)
W79-08371

WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED LAND RESOURCES: APPENDIX D-- FISH AND WILDLIFE,
Pacific Northwest River Basins Commission, Portland, OR. Willamette Basin Task Force.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 749, Price codes: A15 in paper copy, A01 in microfiche. Chaired by the Bureau of Sport Fisheries and Wildlife, 1969, 290 p, 84 tab, 13 fig 11 maps.

Descriptors: *Fish management, *Wildlife management, *Watershed management, *Wildlife conservation, *Fish, *Willamette River(OR), *Wildlife, *River basin development, Oregon, Ecology, Environmental effects, Fish conservation, Dams, Fish establishment, Fish farming, Fish migration, Fish reproduction, Fisheries, Water policy, Fish stocking, Fish hatcheries, Habitat improvement, Big game, Game birds, Non-game birds, Environmental management, Non-migratory birds, Water birds, Furbearers, Mammals, Small animals(Mammals), Reasonable use, Planning, River basins.

This study was undertaken to plan for the proper development of water and related land resources of the Willamette River Basin in Oregon. Appendix D is based on data contained in the three supporting appendices, A through C, and is also

specifically related to some of the other functional appendices. Its purpose is to examine fish and wildlife aspects of the Willamette Basin and develop recommendations which will adequately provide for preservation and improvement of these resources. Resource utilization, effects of settlement and development, and legal and administration regulations are first assessed. This discussion lays the groundwork for a review of the Basin's present use of fish and wildlife resources. Each subbasin of the study area is discussed, followed by a basin-wide inventory and distribution review of big game, upland game, waterfowl, furbearers, predators, and fish. In a section dealing with future demands, projected demands for fish and projected supplies of fish are presented. In a corresponding review of wildlife, hunting pressures, effects of water development projects, and wildlife projections are studied. In discussing alternatives for fish and wildlife management, the cases for improved streamflows, habitat improvement, improved access, propagation, and better programs and projects are made. The study concludes with recommendations for an improved resource management strategy. (See also W79-08433) (Zayac-NC)
W79-08437

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

IDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and B. M. Myers.
Geological Survey open-file report 79-331, 1979. 80 p, 1 fig, 2 ref.

Descriptors: *Data storage and retrieval, *Information exchange, *Organizations, Indexing, Data transmission, *Organization identification code, Computerized data systems, *U.S. Geological Survey, National Water Data Exchange(NAWDEX).

This report contains codes for the identification of public and private organizations listed in computerized data systems. These codes are used by the U.S. Geological Survey's National Water Data Exchange (NAWDEX), National Water Data Storage and Retrieval System (WATSTORE), National Cartographic Information Center (NCIC), and Office of Water Data Coordination (OWDC). The format structure of the codes is discussed and instructions are given for requesting new codes. (Woodard-USGS)
W79-08386

10F. Preparation Of Reviews

SNOW ACCUMULATION, DISTRIBUTION, MELT, AND RUNOFF,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W79-08078

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 18
SEPTEMBER 15, 1979

W79-08501 -- W79-08830
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SELECTED WATER RESOURCES ABSTRACTS is produced by the Office of Water Research and Technology, U.S. Department of the Interior, and published twice monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce, for the Water Resources Scientific Information Center (WRSIC).

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 18
SEPTEMBER 15, 1979

W79-08501 -- W79-08830

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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02 WATER CYCLE
Includes the following Groups: General; Precipitation, Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff, Groundwater, Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion, Water Yield Improvement, Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

THE ESTIMATION OF GROUNDWATER RECHARGE,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and C. Ward.
Journal of Hydrology, Vol. 41, No. 3/4, p 345-361, May 1979. 6 fig, 4 tab, 16 ref.

Descriptors: *Groundwater recharge, *Methodology, *Estimating, *Hydrologic budget, Model studies, Water balance, Evapotranspiration, Soil moisture, Precipitation(Atmospheric), Runoff, Vegetation effects, Foreign countries, Foreign research, *England, Penman method, Grindley method, Chalk aquifer.

Methods of estimating groundwater recharge in temperate climates were reviewed, and it was suggested that the conventional method of Penman and Grindley tends to under-estimate the recharge. An alternative recharge mechanism was proposed which allows recharge to occur even when a soil moisture deficit exists. The implications of this approach were examined by considering a Chalk aquifer in North Lincolnshire. (Visocky ISWS)
W79-08566

DIURNAL VARIATIONS IN STREAM DISCHARGE AND THROUGHFLOW DURING A PERIOD OF LOW FLOW,
Huddersfield Polytechnic (England). Dept. of Geography.
T. P. Burt.
Journal of Hydrology, Vol. 41, No. 3/4, p 291-301, May 1979. 9 fig, 10 ref.

Descriptors: *Low flow, *Streamflow, *Discharge(Water), Hydrologic aspects, Evaporation, Soil water movement, Flow, Droughts, Saturated soils, Diurnal, Soil moisture, Chemical properties, *Throughflow, Chemical concentration.

During the drought of 1976, the hydrological response of Bicknoller Combe, Somerset, England, was characterized by a marked diurnal oscillation of stream discharge. Observations of throughflow also showed a clear diurnal variation. Soil water potential data from tensiometer records indicated a flow reversal to occur with flow towards the soil surface during the day in response to intense evapotranspiration, and at night indicated the resumption of downslope soil water movement. Diurnal oscillation of stream discharge is seen as the direct result of changes in the size of the saturated wedge which are produced by the periodic variation in the rate of evapotranspiration. Observations of diurnal variation in the solute concentration of stream water also were briefly described. (Lee-ISWS)
W79-08568

STREAM GAUGING INFORMATION, AUSTRALIA - FOURTH EDITION,
Australian Water Resources Council, Canberra.
1978. 180 p, 1 fig, 10 tab, 2 append. Australian Government Publishing Service, Canberra.

Descriptors: *Stream gages, *Gaging stations, *Hydrography, Water measurement, Australia, Streamflow, Discharge measurement, Stations, Flow measurement, Data collections, On-site data collections, River basins.

Information on the 4951 stations in Australia where hydrographic data are or have been collected is presented in this catalog. Details are given for each station including national gauging station number, location, catchment area, type of data collected, period of record, water quality, the authority collecting the data, and, where available, statistics on the annual discharges of streamflow. Years of commencement and closure, transfers of stations from one organization to another, and remarks which serve to amplify particular details of a station are also included. Information is arranged by the twelve drainage divisions, which are subdivided by river basins. Stations are classified as to their use: stream gauge, tidal gauge, flood warning or emergency station, representative basin station, small rural catchment station, or other. Station sites include: streams or natural watercourses, canals, lakes, estuaries, urban areas, and other areas. (Schaefer-IPA)
W79-08603

WATER IN MISSOURI,
Department of Natural Resources, Jefferson City, MO. Div. of Geology and Land Survey.
B. Harris.
Educational Series No. 5, 1979. 27 p, 19 fig, 3 tab, 7 ref.

Descriptors: *Missouri, *Education, *Hydrologic cycle, *Groundwater, *Surface waters, Water utilization, Water quality, Water supply, Water resources development, Water pollution, Water sources, Reservoirs, Hydroelectric power, Springs, Lakes.

One of Missouri's most important natural resources is water. Water moves in a never-ending cycle, circulating among sky, land, ocean, and back to the sky--called the hydrologic cycle. The average annual precipitation in the U.S. is 30 inches, providing 4,200 billion gallons of water per day. About 600 billion gallons per day are available for domestic, industrial, municipal, and agricultural requirements. The nation's daily water use was 420 billion gallons (excluding hydroelectric power) in 1975. In Missouri in 1975, daily water use was 4.1 billion gallons. The sources of water in Missouri are surface water and groundwater. The report defined 'surface water' and 'groundwater', explained how much of each is available, showed what the sources are, and indicated where small, medium, and large quantities of surface water and groundwater are found in the state. Also included in the report was a description of water use, water development, and water problems in Missouri. (Froehlich-ISWS)
W79-08613

DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENT CORES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
A. C. Hurtt, and J. G. Quinn.
Environmental Sciences and Technology, Vol. 13, No. 7, p 829-836, July 1979. 8 fig, 2 tab, 27 ref. NSGP 04715844088.

Descriptors: *Organic compounds, *Rhode Island, *Sediments, *Cores, *Estuaries, Bays, Sampling, Oil, Oil spills, Pollutants, Water pollution, Water pollution sources, Chemicals, Chemical analysis, Chromatography, Sedimentation, Depth, Distribution patterns, Spatial distribution, *Narragansett Bay(RI).

Twenty cores were analyzed to provide data on the distribution of sedimentary hydrocarbons from various areas of Narragansett Bay. There was a decrease in surface (0-5 cm) sediment hydrocarbons from the Providence River to the mouth of the bay, and the concentrations also decreased with depth in the cores, generally levelling off at 20-25 cm. This depth is probably related to increased petroleum utilization at the end of the 19th century. Several areas of the bay showed increasing hydrocarbons with depth, but the exact cause of this phenomenon could not be determined. The results of this study indicated that the major source of anthropogenic hydrocarbons in bay sediments is the Providence River. These compounds are introduced into the bay via tidal transport of suspended material from the river and undergo gradual sedimentation throughout the estuary. (Sims-ISWS)
W79-08625

RELATIONSHIPS BETWEEN SMALL WATER BODIES AND GROUNDWATER,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
F. R. Hall.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 248-261, September 1976. 3 fig, 1 tab, 32 ref.

Descriptors: *Surface-groundwater relationships, *Lakes, *Groundwater movement, *Water balance, Ponds, Groundwater, Analytical techniques, Mathematical models, Methodology, Hydrologic cycle, Flow.

The purpose of this paper was to outline the important factors which determine whether a lake receives groundwater inflow, contributes to groundwater outflow, or both. The emphasis was on the movement of water and the flow paths followed. Therefore, the energy or head distribution within the aquifer was of major interest. Emphasis was placed on natural, permanent ponds and small lakes which are situated in unconsolidated sediments overlying an impermeable bedrock and which are located in subhumid or humid regions. Groundwater flow was assumed to occur mainly under unconfined conditions. Knowledge is required of the subsurface stratigraphy and the values for the various layers and lenses of permeability, permeability contrasts, and anisotropy. In practice, difficulties arise in obtaining this knowledge even with fairly complete studies. A reasonably detailed water balance of the water body allows evaluation of the possibilities for groundwater inflow and/or outflow. Groundwater flow simulations by digital computer, particularly for steady conditions in vertical section, are useful in conceptualizing the situation of interest. Needless to say, the results of such simulations should carefully interpreted in the light of available field evidence. (See also W79-08631) (Humphreys-ISWS)
W79-08650

REPRESENTING STREAM AQUIFER INTERACTION,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W79-08651

STOCHASTIC MANAGEMENT OF A STREAM-AQUIFER SYSTEM,
Universidad Nacional Automona de Mexico, Mexico City. Inst. de Geofisica.
For primary bibliographic entry see Field 6A.
W79-08655

COOPER RIVER ENVIRONMENTAL STUDY,
South Carolina Water Resources Commission, Columbia.
For primary bibliographic entry see Field 4A.
W79-08830

2B. Precipitation

URBAN EFFECTS ON PRECIPITATION: A REVIEW,
Natal Univ., Durban (South Africa). Dept. of Geography.
R. D. Diab.
South African Journal of Science, Vol. 74, No. 3, p 87-91, March 1978. 3 fig, 57 ref.

Descriptors: *Precipitation(Atmospheric), *Cities, *Weather patterns, Metropolitan Meteorological Experiment(METROMEX), Local precipitation, Meteorology, Rainfall, Urbanization, Condensation, Meteoric water, Weather data, Climatology.

The suggested causal mechanisms underlying observed precipitation anomalies over cities are examined, and the historical development of urban precipitation studies is traced. Four possible modifications of the atmosphere may be responsible for urban-induced changes in precipitation: (1) increased thermal mixing due to the effects of the well-established heat island and anthropogenic heat input, (2) increased mechanical mixing due to greater aerodynamic roughness of urban structures, (3) changes in low-level atmospheric mois-

ture content, and (4) the addition of condensation and ice nuclei from industrial and motor vehicle discharges. In 1971, in response to a well-recognized need, METROMEX (Metropolitan Meteorological Experiment) was initiated to study the effects of urbanization on precipitation. The three objectives of METROMEX were to determine the reality of precipitation anomalies, to determine the factors responsible for the observed anomalies, and to develop models capable of predicting urban precipitation anomalies. The results from METROMEX strongly suggest that modifications in the precipitation process can be caused by urban areas and their associated thermodynamic, mechanical, and atmospheric compositional changes. The exact magnitude of this relationship is still uncertain due to effects of topography and variability of rainfall. (Schaefer-IPA)
W79-08519

HYDROLOGICAL, METEOROLOGICAL, AND AGRICULTURAL RELATIONS IN NORTHERN IRAQ,
Ministry of Irrigation, Baghdad (Iraq).
For primary bibliographic entry see Field 3F.
W79-08561

A TECHNIQUE FOR THE DIRECT MEASUREMENT OF WATER STORAGE ON A FOREST CANOPY,
University of Strathclyde, Glasgow (Scotland). Dept. of Applied Physics.
N. H. Hancock, and J. M. Crowther.
Journal of Hydrology, Vol. 41, No. 1/2, p 105-122, April 1979. 7 fig, 1 tab, 19 ref.

Descriptors: *Canopy, *Water storage, *Forests, Technology, Storage, Hydrology, On-site investigations, Calibrations, Measurement, Meteorology, Trees, Equations, *Hafren Forest(Wales), *Wales, Hydrometeorological variable, Sitka spruce, Water-laden branch, Cantilever deflection.

A method was presented for the continuous measurement of water stored on a forest canopy located in Hafren Forest, Wales. The novel method used the cantilever deflection of a water-laden branch. A description of the necessary instrumentation was presented, and the validity was demonstrated. Calibration methods and results were discussed, and the extrapolation from individual branches to a complete canopy was considered. A description was given of a continuous two-year experiment, and a sample of the recorded data was shown and analyzed for canopy water storage. In particular, a storage capacity of 2.5 + or - 0.4 mm was found for a closed Sitka spruce canopy. A preliminary analysis of dynamic events allowed a test of some of the hypotheses made in a Rutter model. In particular, the exponential form of evaporation from a completely wet but unsaturated canopy was verified, and aerodynamic resistance values were calculated directly. (Roberts-ISWS)
W79-08577

DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENT CORES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2A.
W79-08625

2C. Snow, Ice, and Frost

SNOWPACK GROUND TRUTH, DONNER PASS SITE, SODA SPRINGS, CALIFORNIA, JANUARY 18, 1977,
Bittinger (M.W.) and Associates, Inc., Fort Collins, CO.
E. B. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-25605, Price codes: A02 in paper copy, A01 in microfiche. Mission Report, February 1977. 13 p, 4 fig, 4 tab.

Descriptors: *Snowpacks, *Surveys, *California, Snow, On-site investigations, Depth, Strength, Density, Moisture content, Crystals, Mountains, Snow surveys, Snow cover, Remote sensing, Aircraft, *Donner Pass(CA), *Soda Springs(CA).

This report contained the ground-truth data taken near Soda Springs, California, in support of the NASA Airborne Instrumentation Research Program. The location of the Donner Pass Site is just southeast of Soda Springs, California. The flight line traversed much of Lake Van Norden. The dam on Lake Van Norden has been breached in such a manner as to prevent the storage of water. For this reason, much of the flight line passed over the former lake bed. Ground-truth data taken in support of this mission were as follows: (1) snow depths were taken every 400 feet; (2) snow densities were taken every 1200 feet; (3) two snowpits were dug, and limited density, vertical layer classifications, and soil observations were taken; and (4) temperatures of the upper 6 inches of the snowpack were taken at one location. (Sims-ISWS)
W79-08548

TEMPERATURE PATTERNS IN AN ALPINE SNOW COVER AND THEIR INFLUENCE ON SNOW METAMORPHISM,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
E. R. La Chapelle, and R. L. Armstrong.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 169, Price codes: A03 in paper copy, A01 in microfiche. Technical Report, February 1977. 37 p, 15 fig, 3 tab, 10 ref. ARO DAHC04-75-G-0028, DAHG29-76-G-0088.

Descriptors: *Snow, *Snow cover, *Temperature, *Colorado, *Model studies, Snow packs, Strength, Crystals, Radiation, Solar radiation, Heating, Mathematical models, On-site investigations, Sampling, Data processing, Meteorology, *Snow metamorphism, Recrystallization.

Spatial and temporal variations of temperature in alpine snow covers were systematically observed over a period of two winters. Concurrently, snow crystal metamorphism was monitored in the same snow covers, along with such basic snow properties as density and ram resistance. Near-surface snow temperatures fluctuate widely in response to diurnal weather variations. Below surface about 25 cm, the temperatures change more slowly in response to longer-term weather trends. Mean snow temperatures are colder on north slopes than south ones, but mean snow cover temperature gradients are similar on both exposures owing to shallower snow on south slopes. A forest canopy tends to suppress snow surface radiation cooling and hence reduces magnitude of temperature gradients at depth. Metamorphism in snow follows a recrystallization mode with declining mechanical strength when the saturation water vapor pressure gradient exceeds 0.05 mb/cm. Owing to a nonlinear vapor pressure-temperature relationship over ice, this corresponds to the conventional critical temperature gradient of 0.1 deg C/cm for this metamorphism mode only at snow temperatures close to the melting point. Mean monthly snow temperature gradients can reasonably be estimated from air temperature and snow depth means, but this method can be extended to vapor pressure gradients only if appropriate corrections for non-linearity are introduced. (Sims-ISWS)
W79-08579

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 2.
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
April 1979. 144 p.

Descriptors: *Glaciology, *Snow, *Ice, Bibliographies, Computers, Snow cover, Glaciers, Avalanches, Polar regions, Sea ice, Permafrost, Abstracts, Data collections, Publications, Paleoglaciology, Polar ice.

The quarterly list of documents acquired by the Data Center during the period September-December 1978 has been published. Books, technical reports, conference proceedings and reprints were included; most journal articles have not yet been indexed. The subject headings were those used by the Army Cold Regions Research and Engineering Laboratory in their Bibliography on Cold Regions Sciences and Technology. Bibliographic items are repeated in their entirety under each appropriate subject heading. (Froelich-ISWS)
W79-08612

2D. Evaporation and Transpiration

HAS THE PRIESTLEY-TAYLOR EQUATION ANY RELEVANCE TO FOREST EVAPORATION,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2I.
W79-08552

THE 'EVAPORATION BRUSH', AN EVAPORIMETER FOR MEASURING THE POTENTIAL EVAPORATION OF MEADOW GRASS,
Heidemaatschappi BeheerN.V., Arnhem (Netherlands). Research Dept.
C. L. Palland.
Journal of Hydrology, Vol. 41, No. 3/4, p 363-369, May 1979. 6 fig, 8 ref.

Descriptors: *Evaporimeters, *Grasses, *Evaporation, Evapotranspiration, Grasslands, On-site investigations, Evaporators, Heat flow, Soil moisture, Instrumentation, *Evaporation brush, *Meadow grass, *The Netherlands, Potential evaporation, Brush fibers, Penman formula, Pertinax, Registration unit, Dalton formula.

A new type of evaporimeter, called the 'evaporation brush', was described. It measures continuously the evaporation rate. The operation of the evaporation brush was tested in a field of meadow grass which is sufficiently supplied with soil moisture. It was found that the evaporation measured by this device in meadow grass during periods of one hour and 24 hours compares well with calculated data for meadow grass from a modified Penman formula. The instrument must be tended only once a week. (Roberts-ISWS)
W79-08565

THE ESTIMATION OF GROUNDWATER RECHARGE,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-08566

SOME OBSERVATIONS ON THE PERIODIC VARIATIONS OF MOISTURE IN STABILISED AND UNSTABILISED SAND DUNES OF THE INDIAN DESERT,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 2G.
W79-08573

EVAPORATION OF WATER FROM SAND: THE EFFECT OF EVAPORATION ON THE PRECIPITATION OF SALTS DISSOLVED IN WATER STORED IN SAND,
National Inst. for Water Research, Windhoek (South West Africa).
D. H. R. Hellwig.
Journal of Hydrology, Vol. 41, No. 1/2, p 140-151, April 1979. 3 fig, 2 ref.

Descriptors: *Evaporation, *Evaporation pans, *Water, *Sands, Salts, Carbonates, Precipitation(Atmospheric), Rational formula, Rivers, *Precipitation of salts, *Sand beds, Windblown quartz sand, Evaporation tanks, Salt concentration, Cumulative salt increase, Carbonate ions.

The relationship between evaporation of water out of sand beds and the loss of salts from solution was formulated by Hellwig in 1974 as a hyperbolic function. The results of a subsequent experiment did not confirm this relationship. The experimental setup for both experiments was identical to the one

described by Hellwig earlier in 1973. Hellwig had used a natural river sand in his 1974 test. In contrast, a wind-blown quartz sand, free of acid soluble salts, was used by the author. Results of 8 evaporation tanks, i.e., from 0-700 mm below the sand surface, were evaluated for a period of 847 days. The theoretical and actual increase in the concentration of salts in the water of the evaporation tanks was calculated in the same way as the 1974 test. Both sets of results showed a straight-line relationship that indicated the precipitation of $CaCO_3$ as a result of evaporation of feed water was a continuous process which was not reversed during rainy periods. Also, the precipitation of non-carbonate salts was a continuous process which was temporarily reversed in both tests by resolution of salts during rainy periods. The tests established a straight-line relationship for evaporation and carbonate salts lost from solution. (Roberts-ISWS)
W79-08574

THE SENSITIVITY OF PARAMETERS IN THE PENMAN EVAPORATION EQUATIONS AND DIRECT RECHARGE BALANCE,
Birmingham Univ. (England). Dept. of Geological Sciences.
K. W. F. Howard, and J. W. Lloyd.
Journal of Hydrology, Vol. 41, No. 3/4, p 329-344, May 1979. 3 fig, 4 tab, 20 ref, 1 append.

Descriptors: *Evaporation, *Recharge, *Parametric hydrology, Hydrology, Analysis, Infiltration, Albedo, Soil moisture, Radiation, Temperature, Hydrologic cycle, Equations, *Penman evaporation equations, *Great Britain, *Lincolnshire Chalk Aquifer(Great Britain), Parameters, Sensitivity analysis, Wet-bulb temperature, Capillary forces, Potential evaporation, Daily recharge estimates.

The various parameters in the Penman equations and direct recharge balance were varied to determine their influence on the calculated evaporation and recharge amounts. The sensitivity analysis was applied to data from an area north of the north Lincolnshire Chalk aquifer. Evaporation estimates were found to be particularly sensitive to albedo, radiation constants, and wet-bulb temperatures. The resultant differences, in turn, significantly affected recharge estimates. The study also indicated the need to use daily computations of recharge in place of the normally used ten daily or monthly computations. (Roberts-ISWS)
W79-08618

2E. Streamflow and Runoff

CHANNEL FLOW COMPUTATIONS USING CHARACTERISTICS,
Lanchester Polytechnic, Coventry (England). Dept. of Civil Engineering.
K. Sivaloganathan.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14717, p 899-910, July 1979. 3 fig, 3 tab, 19 ref, 2 append.

Descriptors: *Numerical analysis, *Open channel flow, *Unsteady flow, *Flood routing, Hydraulics, Stability, Mathematical models, Model studies, Equations, Streams, Channels, Computers, *Method of characteristics, Differential equations, Finite difference analysis, Courant condition, Computer time.

The direct formulation of the rectangular grid broken characteristic method can be used without adherence to the Courant condition. When small distance steps are used, time steps with large Courant numbers may be used with relatively little loss of accuracy. Larger distance steps require the restriction of the Courant numbers to smaller values to maintain reasonable accuracies. Considerable savings in computation times are possible as a result. Restriction of the magnitude of the Courant number allowed seems to be needed only from the point of view of accuracy. (Adams-ISWS)
W79-08556

MINIMUM STREAM POWER AND RIVER CHANNEL PATTERNS,
San Diego State Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-08567

DIURNAL VARIATIONS IN STREAM DISCHARGE AND THROUGHFLOW DURING A PERIOD OF LOW FLOW,
Huddersfield Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-08568

A REVIEW OF DATA ESTIMATION PROCEDURES AND ASSOCIATED ERRORS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
T. A. McMahon.
Journal of Hydrology, Vol. 14, No. 1/2, p 1-10, April 1979. 3 fig, 26 ref.

Descriptors: *Model studies, *Mathematical models, *Computer models, *Streamflow, Stream gages, Gaging station, Data processing, Mapping, Runoff, Rainfall, Precipitation excess, Hydrology, Data estimation.

This paper was the outcome of a review carried out within the framework of an analysis concerned with an economic evaluation of Canada's hydrometric network. For this reason, it contained several techniques which are peculiar to Canada, but nevertheless, the conclusions should be universally applicable. Procedures were reviewed for determining monthly flows, basic hydrologic parameters, and characteristics at a gauging station as well as their associated errors. There is a range of techniques that can be used to estimate flows, flow parameters, and characteristics when data are not available or when the record is short. Large errors are involved with some procedures, for example, isolines of mean annual runoff and low flow estimates using regression analysis. It was noted that the more accurate procedures are the more complex. Their applicability depends on the significance of the project and the availability of trained personnel to use the models. (Sims-ISWS)
W79-08576

FLOODPLAIN PAINS,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 4A.
W79-08597

VARIABILITY OF RUNOFF IN AUSTRALIA,
Australian Water Resources Council Canberra.
Hydrological Series No. 11, 1978. 45 p, 6 fig, 3 tab, 55 ref, 2 append. Australian Government Publishing Service, Canberr.

Descriptors: *Runoff, *Rainfall-runoff relationships, *Streamflow, Australia, Rainfall, Hydrologic data, Water resources, Variability, Mapping, Data collections, Analysis.

Results of the first Australia-wide study of variability of runoff are presented. Maps detail runoff and streamflow; a discussion of the maps is included. Essentially simple techniques were used in the analysis; sophisticated modelling was rejected because of the large areas and range of variables involved. The greater part of the study dealt with annual totals of runoff; monthly totals of stream discharge are also discussed. Stream discharge statistics, maps of mean annual runoff, rainfall maps and statistics, and maps showing landform types or contours were the main data used for the study. Methods used for plotting the isopleths of depth of runoff varied with the type and density of data available. Two indices of relative annual variability were calculated and mapped since the annual percentage values shown on the maps were not by themselves entirely adequate for comparing relative runoff variations at different places. (Schaefer-IPA)
W79-08599

HYDROLOGIC DROUGHT IN THE HUMBOLDT BASIN, NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
V. L. Gupta, and R. J. Pautsch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 639, Price codes: A05 in paper copy, A01 in microfiche. Technical Report, H-W Series No. 35, June 1979. 91 p, 9 fig, 37 tab, 36 ref, 3 append. OWRT A-086-NEV(2), 14-31-0001-8030.

Descriptors: *Droughts, *Hydrologic cycle, Hydrology, Humboldt Basin, Streamflow, Streamflow forecasting, Climatology, Precipitation(Atmospheric), Hydrologic data, Agriculture.

Precipitation and streamflow in the Humboldt Basin were analyzed for statistical properties such as randomness, cyclical behavior, and wet and dry period clustering effects in order to draw systematic inferences concerning the delineation of drought. There are no standard or unified definitions of drought; for this analysis, drought was defined as a shortage of water supply compared to established or prevailing demand. Loosely defined cycles of approximately 41 and 29 years may be indicated by the serial correlation coefficients for eastern Humboldt Basin precipitation at Elko and Humboldt River streamflow at Palisade which are statistically significant at lags. It is not possible to predict future droughts using cyclical behavior; the best hope for this lies in establishing a correlation of sufficient lead time between ocean temperatures in the North Pacific and west coast precipitation. A non-random grouping of dry years for precipitation and a tendency for one very low precipitation year to be followed by another are indicated. Log-extremal (Gumbel) type I and II distributions were used for observed drought-event data and a theoretical curve respectively. The ability of drought flows to meet agricultural demands in the area was also examined. (Schaefer-IPA)
W79-08604

A VERIFICATION OF THE QUAL-1 WATER QUALITY MODEL FOR THE LOWER MISSISSIPPI RIVER,
Texas Univ. at Arlington. Dept. of Computer Science and Engineering.
For primary bibliographic entry see Field 5B.
W79-08616

REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1978 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 6E.
W79-08685

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1978,
Geological Survey, Helena, MT. Water Resources Div.
R. J. Omang, C. Parrett, and J. A. Hull.
Geological Survey open-file report 79-522, March 1979. 112 p, 2 fig.

Descriptors: *Annual peak discharge, *Small watersheds, *Montana, *Floods, *Flood frequency, Crest-stage gages, Streamflow, Flow rates, Hydrologic data, *Missouri River basin, *Columbia River basin.

Annual peak stage and discharge data have been collected and tabulated for crest-stage gaging sites in Montana. The crest-stage program was begun in July 1955 to investigate the magnitude and frequency of floods from small drainage areas. The program has expanded from 45 crest-stage gaging stations initially to 173 stations maintained in 1978. Data are tabulated for the period of record. (Woodard-USGS)
W79-08687

Group 2E—Streamflow and Runoff

STREAMFLOW SIMULATION STUDIES OF THE HILLSBOROUGH, ALAFIA, AND ANCLOTE RIVERS, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. F. Turner, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 569, Price codes: A08 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 78-102, 1979. 161 p, 22 fig, 14 tab, 22 ref.

Descriptors: *Streamflow forecasting, *Simulation analysis, *Flood profiles, *Flood peak, *Streamflow forecasting, Hydrographs, Floods, Surface-groundwater relationships, Watersheds(Basins), Flood control, Computer models, Mathematical models, *West-central Florida, *Soil-moisture accounting, *Reservoir routing, *Channel routing.

A modified version of the Georgia Tech Watershed Model was applied for the purpose of flow simulation in three large river basins of west-central Florida. Calibrations were evaluated by comparing the following synthesized and observed data: annual hydrographs for the 1959, 1960, 1973 and 1974 water years, flood hydrographs (maximum daily discharge and flood volume), and long-term annual flood-peak discharges (1950-72). Annual hydrographs, excluding the 1973 water year, were compared using average absolute error in annual runoff and daily flows and correlation coefficients of monthly and daily flows. Correlations coefficients for simulated and observed maximum daily discharges and flood volumes used for calibrating range from 0.91 to 0.98 and average standard errors of estimate range from 18 to 45 percent. Correlation coefficients for simulated and observed annual flood-peak discharges range from 0.60 to 0.74 and average standard errors of estimate range from 33 to 44 percent. (Woodard-USGS)
W79-08692

FLOOD OF NOVEMBER 8-10, 1977, IN NORTHEASTERN AND CENTRAL NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
R. D. Schopp, and A. J. Velnich.
Geological Survey open-file report 79-559, April 1979. 33 p, 5 fig, 4 tab, 7 ref.

Descriptors: *Flood data, *Peak discharge, *Flood profiles, *New Jersey, Streamflow, Flood discharge, Flow rates, Gaging stations, Flood damage, Flood frequency, *Flood-crest data.

This report documents hydrologic and meteorologic aspects of flooding in northeastern and central New Jersey during November 8-10, 1977. Peak stages and discharges at 51 streamflow gaging sites are tabulated and compared to previous maximums. High-water flood crest elevations are presented for eight stream reaches in or near Bergen County where the most severe flooding occurred. While no lives were lost, 21,700 homes were affected and 96 million dollars of damage resulted. (Woodard-USGS)
W79-08693

ELEVATIONS AND DISCHARGES PRODUCED BY A SIMULATED FLOOD WAVE ON THE LOWER SABINE RIVER, LOUISIANA AND TEXAS, CAUSED BY A THEORETICAL DAM FAILURE,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08697

2F. Groundwater

HYDROGEOLOGY OF THE OYEN AREA, ALBERTA,
Research Council of Alberta, Edmonton.
D. M. Borneuf.
Report 78-2, 1979. 37 p, 1 map, 30 ref, 1 append.

Descriptors: *Canada, *Hydrogeology, *Groundwater, *Data collections, Aquifers, Maps, Bedrock, Water quality, Vegetation, Grasses, Geology, Topography, Chemistry, Water chemistry, Climates, Drainage, Nitrates, Fluorides, Iron, Salts, Water yield, *Alberta(Canada), *Oyen(Alberta), Late Cretaceous Age.

The Belly River, Bearpaw, and Horseshoe Canyon Formations of Late Cretaceous age constitute the upper bedrock in the map area. The surficial deposits are generally quite thin (usually less than 50 ft or 15 m) with the exception of buried valley deposits which can be as much as 500 ft thick (150m). Yields vary from 1 to 25 igpm (0.07 to 2 L/s) over most of the map area in both bedrock and surficial sediments; however, extensive pump testing of the Bulwark sandstones of the Bearpaw Formation in the northwestern corner of the map area has indicated a yield range of 25 to 500 igpm (2 to 40 L/s) in a small area. Groundwater quality is generally poor, and areas of salt deposits are very common over all the map area. Lithology for 9 test holes was tabulated in the appendix. (Froehlich-ISWS)
W79-08549

HYDRGEOLOGY OF THE BRAZEAU--CANOE RIVER AREA, ALBERTA,
Research Council of Alberta, Edmonton.
R. G. Barnes.
Report 77-5, 1978. 33 p, 2 tab, 1 map, 34 ref, 1 append.

Descriptors: *Canada, *Hydrogeology, *Rivers, *Data collections, Groundwater, Surface waters, Bedrock, Aquifers, Chemistry, Iron, Fluorides, Water chemistry, Topography, Maps, Drainage, Vegetation, Climates, Ponds, Springs, Wells, Water quality, Water yield, Geology, Karsts, *Brazeau-Canoe River(Canada), *Alberta(Canada), Surficial geology.

The hydrogeology of surficial aquifers and shallow bedrock aquifers of the uppermost 500 ft of strata in Brazeau-Canoe River map area was described. Lithology, geologic structure, topographic position, and climate are the major elements of the hydro-geological regime. Within the Rocky Mountain Main Ranges and Front Ranges, limestone and dolomite are the dominant rock types. A synthesis of the geologic and geomorphologic characteristics of these rocks indicates that conduits and fractures are the major mode of storage and transmission of groundwater. Thrust faults have a strong influence on valley position and extend for many miles along strike. They have the potential of directing groundwater flow from distant sources toward localized surface discharge points within the valley floors. The valley floors serve as regional and local groundwater drains. The most prospective bedrock aquifers of the Foothills belt occur in the Upper Cretaceous Blairmore Group. Fracture permeability is well developed in thick sandstone units and coal beds. The Upper Cretaceous to Tertiary Brazeau Formation extends to depths of greater than 1000 ft in the Western Alberta High Plains. Intergranular and fracture porosity have a patchy distribution within these clayey and sometimes bentonitic sandstones and mudstones. The valley floor glaciofluvial and alluvial sand and gravel deposits are the most prospective aquifers of the map area. Groundwater availability and yield potential are dependent on the topographic position, permeability, saturated thickness, and recharge characteristics of these deposits. With the exception of the local occurrence of calcium-magnesium sulfate type groundwater in the Front Ranges (which can contain over 2000 ppm total dissolved solids), groundwater quality is excellent throughout the map area, and total dissolved solids contents rarely exceed 500 ppm. (Froehlich-ISWS)
W79-08550

HYDROGEOLOGY OF THE LESSER SLAVE LAKE AREA, ALBERTA,
Research Council of Alberta, Edmonton.
R. I. J. Vogwill.
Report 77-1, 1978. 32 p, 6 fig, 1 tab, 3 map, 28 ref, 2 append.

Descriptors: *Canada, *Hydrogeology, *Groundwater, *Lakes, Maps, Aquifers, Sands, Gravels, Topography, Mapping, Bedrock, Surface waters, Chemistry, Water chemistry, Rocks, Dissolved solids, Chemical analysis, Geology, Drainage, Vegetation, Forests, Climates, Geomorphology, Land use, Data collections, Climatology, Muskeg, Bogs, Sodium compounds, Calcium compounds, *Alberta(Canada), *Lesser Slave Lake(Canada), *Swan River(Canada), Surficial geology, Hydrochemistry.

The hydrogeology of the Lesser Slave Lake area (NTS 830) was described. Data were unevenly distributed and have been supplemented with field observations and test drilling program during 1974. A large amount of interpretation was involved in the construction of the hydrogeological map and profiles. The most important aquifers in the area are basal or near-basal sands and gravels occurring in preglacial drainage networks. They have been assigned a 20-year safe yield of 25 to 500 igpm (approximately 2 to 38 l/sec). The most important bedrock aquifers are sandstones and coals of the Wapiti Formation which have been assigned a 20-year safe yield of 5 to 25 igpm (approximately 0.4 to 2 l/sec). Water chemistry is variable, and total dissolved solids contents range from 200 to 2000 ppm in the drift and nonmarine strata. Iron concentrations are usually very high. Groundwaters are generally of the Ca or Na/HCO3+CO3 type with local areas of (1) Ca or Na/SO4 types attributed to high sulfate contents in till, and (2) Na+Ca/Cl types attributed to contamination from deeper marine strata. These deeper marine rocks contain highly saline waters of the Na/Cl type. (Froehlich-ISWS)
W79-08551

ENVIRONMENTAL ISOTOPES IN A STUDY OF THE ORIGIN OF SALINITY OF GROUNDWATER IN THE MEXICALI VALLEY,
International Atomic Energy Agency, Vienna (Austria).
B. R. Payne, L. Quijano, and D. Latorre.
Journal of Hydrology, Vol. 41, No. 3/4, p 201-215, May 1979. 9 fig, 3 tab, 9 ref.

Descriptors: *Stable isotopes, *Colorado River, *Deuterium, *Oxygen isotopes, *Groundwater, *Mexico, Salinity, Infiltration, Evaporation, Saline waters, Sampling, Isotope studies, Correlation analysis, Surface waters, Connate water, Evaporites.

The stable-isotopic and chemical composition of waters in the Mexicali Valley were used to study the origin of salinity of groundwater. It was suggested that the present-day stable-isotopic composition of the Colorado River when it enters the valley is more enriched than three or four decades ago owing to evaporation from the reservoirs which have been constructed on the river during this period. This has provided distinctive isotopic labels for 'old' and 'recent' Colorado River water. On the basis of the sampling, no evidence was found for the salinity being due to partial mixing with seawater. The dominant salinity control is infiltration from the surface-water system, but evidence also was presented for part of the salinity being due to dissolution of evaporitic deposits. (Visocky-ISWS)
W79-08572

ANALYTICAL SOLUTIONS TO THE PROBLEMS OF TRANSIENT DRAINAGE THROUGH TRAPEZOIDAL EMBANKMENTS WITH DARCIAN AND NON-DARCIAN FLOW,
Center for Water Resources Development and Management, Trivandrum (India).
P. Basak, and M. R. Madhav.
Journal of Hydrology, Vol. 41, No. 1/2, p 49-57, April 1979. 6 fig, 5 ref.

Descriptors: *Dewatering, *Drainage, *Embankments, *Theoretical analysis, *Unsteady flow, Equations, Porous media, Darcys law, Drawdown, Flow, Non-Darcy flow, Reservoir drawdown.

Under certain simplifying assumptions, three analytical solutions to the problems of transient non-

Darcy drainage through trapezoidal embankments with a central impermeable core were presented. The solutions showed the effect of the non-Darcian parameter, n, on the rate of drainage progress for various geometries of the embankments. The results were compared with the known expression for Darcian flow. For Darcian flow, a solution for the problem with inclined central core and partial drawdown also was reported for the first time. (Adams-ISWS)
W79-08575

OCCURRENCE OF GROUNDWATER IN THE SATPURA HILLS REGION OF CENTRAL INDIA,
Geraghty and Miller, Inc., Annapolis, MD.
V. W. Uhl, Jr.
Journal of Hydrology, Vol. 41, No. 1/2, p 123-141, April 1979. 8 fig, 5 tab, 15 ref.

Descriptors: *Groundwater resources, *Groundwater potential, *Washington, Aquifers, Water yield, Weirs, Wells, Hydrology, Specific capacity, Computers, Geology, Groundwater, Rocks, Sandstones, *India, *Well yields, Groundwater development.

The Satpura Hills region of central India is characterized by hilly to mountainous terrain, plateaus, and gently undulating country. The recent drilling of over 500 tubewells in the study area by the Evangelical Lutheran Church Water Development Project provided the data base for this study. Geologically, the area is underlain by a zone of saprolite (weathered rocks), crystalline rocks, basalt, and sandstone. Groundwater flow systems are of the local and intermediate type. Well data such as yield, depth, depth of overburden, and aquifer depth were analyzed statistically according to rock type and topography. Wells drilled in valleys and flat uplands were the most productive, and average well yields in the crystalline rocks (90 l/min) were greater than in basalt (65.5 l/min) and sandstone (36.7 l/min). Frequency distributions of well yields in all three rock types are similar; most wells yield 75 l/min or less. Linear and non-linear relationships between well parameters were analyzed to determine factors affecting well yields. Topographic location and fracturing are the predominant factors affecting well yields in all the rock types. Well yield and specific capacity results were compared to results from areas of similar geology. Incremental well yields for wells in crystalline rocks were found to decrease with depth. Similar results were noted in other areas of crystalline rocks by Landers and Turk. Agreement exists with data of Davis who compared specific capacity data from basalt of the Satpura Hills region and basalt from the State of Washington. It was found that specific capacities for wells in the State of Washington were on the average an order of magnitude higher than specific capacities for wells in the Satpura Hills region. (Lee-ISWS)
W79-08578

THE FEASIBILITY OF USING PONDS AS SHALLOW WELLS IN THE GEORGIA COASTAL PLAIN,
Georgia Southwestern Coll., Americus. Dept. of Earth Science.
B. F. Beck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 635, Price codes: A03 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta. Technical Completion Report No. ERC-02-79, March 1979. 30 p, 2 fig, 3 tab, 18 ref. OWRT A-079-GA(1).

Descriptors: *Shallow wells, *Ponds, Excavation, Sands, Wells, Water wells, Water supply, Particle size, Permeability, Specific yield, Economic feasibility, Feasibility, Yield equations, Groundwater.

The economic feasibility of using large-diameter, shallow wells in the coastal area of Georgia was investigated. The permeability and specific yield of the aquifer must be known in order to calculate the yield of a well. Permeability and specific yield are related to the distribution of grain sizes; a reliable, predictive equation for these has not yet been formulated. Samples of medium sand had permeabilities around 400 gpd per sq ft and specific yield was tabulated to be .45; samples of well-sorted, fine sand measured near 10 gpd per sq ft and had a specific yield of .25. Three techniques can be used to calculate the yield of a large-diameter well: the Papadopulos and Cooper (1967) method; the Zdankus (1975) method; or by analogy with a collector well using the Hantush (1964) solution. Using realistic values for permeability and specific yield, as determined for the coastal area of Georgia, a pond requires the following to obtain a yield of 100,000 gpd in medium sand: a 15 foot depth and a radius of 50 feet pumped to a drawdown of four feet. In finer sand the well must be deeper and have a larger radius and drawdown. Costs of excavating a large size pond may be prohibitive; however, near urban areas where fill is needed a pond could be excavated for the value of the materials removed, at no cost to the owner. (Schaefer-IPA)
W79-08606

WATER IN MISSOURI,
Department of Natural Resources, Jefferson City, MO. Div. of Geology and Land Survey.
For primary bibliographic entry see Field 2A.
W79-08613

THE SENSITIVITY OF PARAMETERS IN THE PENMAN EVAPORATION EQUATIONS AND DIRECT RECHARGE BALANCE,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2D.
W79-08618

MATHEMATICAL MODEL APPLICATION IN GROUND-WATER STUDIES OF IRAN,
Tehran Univ. (Iran). Faculty of Engineering.
F. Ghassemi.
Ground Water, Vol. 17, No. 4, p 359-365, July-August 1979. 2 fig, 2 tab, 36 ref.

Descriptors: *Groundwater, *Aquifers, *Model studies, Mathematical models, Analytical techniques, Methodology, Infiltration, Recharge, Natural recharge, Artificial recharge, Transmissivity, Storage coefficient, Pumping, Irrigation, Water resources, Hydrology, *Iran.

Mathematical models of groundwater aquifers with complex geologic and hydrologic factors have been used effectively since 1960. In these models, first the past hydrogeological conditions are simulated, then it is possible to impose on the model the future conditions by increasing redistributed pumping, artificial recharging, or many other factors which may change the existing hydrogeological conditions. Different numerical methods, such as finite difference, finite element, and dynamic programming, are used in mathematical simulation of the aquifers. The study of different aquifers in Iran by classical methods has been started systematically since 1962, and during this period more than 200 aquifers were studied in reconnaissance phase and about 80 aquifers in semi-detailed phase. In 1967, the mathematical model technique was introduced to groundwater researchers of Iran. Actually, 39 aquifers were studied by 2- or 3-dimensional flow models covering nearly 40,000 sq km of Iranian aquifers. In these studies finite difference methods were used, and only a few aquifers were studied by dynamic programming, but the finite element has never been used in Iran. (Sims-ISWS)
W79-08620

MODELLING RAPID FLOW IN AQUIFERS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and K. S. Rathod.
Ground Water, Vol. 17, No. 4, p 351-358, July-August 1979. 9 fig, 1 tab, 5 ref.

Descriptors: *Groundwater movement, *Aquifer characteristics, *Hydrogeology, *Mathematical models, *Unsteady flow, Hydraulics, Springs, Aquifers, Transmissivity, Storage coefficient, Recharge, Limestones, Model studies, *England.

The situation when, due to heavy rainfall, rapid transfer of water occurs in the upper highly permeable region of an unconfined aquifer was examined. The conventional modelling approach of a single transmissivity, which either remains constant or increases with the saturated depth, was shown to be unsatisfactory. Instead, it is necessary to consider the aquifer as consisting of two systems with flow always occurring in the primary system but only entering the secondary system during periods of high recharge. This is necessary because the velocities in the different regions of the aquifer are of significantly different magnitudes. The Lincolnshire Limestone aquifer in England was used as an illustrative example. Initially, a one-dimensional approximation to the aquifer was considered so that the different features of the flow mechanism could be examined in detail. The method of dividing the recharge between the primary and secondary systems was shown to be of great importance. Then, a preliminary two-dimensional model of the whole region was considered. The model response was shown to be of the same form as that observed in the field. (Adams-ISWS)
W79-08621

SPRING DISCHARGE IN RELATION TO RAPID FISSURE FLOW,
Anglian Water Authority, Peterborough (England). Welland and Nene River Div.
E. J. Smith.
Ground Water, Vol. 17, No. 4, p 346-350, July-August 1979, 6 fig, 10 ref.

Descriptors: *Groundwater movement, *Aquifer characteristics, *Hydrogeology, *Unsteady flow, *Karst hydrology, Hydraulics, Springs, Aquifers, Transmissivity, Recharge, Limestones, *England.

Rapid fissure flow has been recognized as an important factor in understanding the hydraulic behavior of the Lincolnshire Limestone aquifer of eastern England. A study of the hydrogeology of a Lincolnshire Limestone spring-fed catchment enabled 3 zones of discharge to be defined, based on their relative elevation along the valley floor. Comparison of the discharge characteristics of each zone revealed the existence of rapid groundwater flow associated with a discrete fissure system. Comparison of spring discharges and groundwater storage during a period of 'high', 'low', and 'typical' recharge enabled a conceptual flow model of the aquifer to be constructed. A two-layered model was proposed, in which the secondary zone (upper unit) is characterized by higher transmissivity and lower storativity than the primary zone (lower unit). In addition, there is evidence of a rapid increase in transmissivity with water-table elevation in the secondary zone. The areal distribution of the secondary zone is associated with a network of dry valleys. The spatial distribution of the two zones was explained by geological structure, lithological variations, and the post-glacial history of the area. A two-layered model was developed with these concepts in mind in order to simulate the spring discharges. Once proven, the model can be integrated with the regional hydrogeology and incorporated into existing digital models of the aquifer. (Adams-ISWS)
W79-08622

AQUIFER TRANSMISSIVITY FROM SURFICIAL ELECTRICAL METHODS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-08623

GROUND-WATER INDUCED CHANGES IN LAKE CHEMISTRY,
University of South Florida, Tampa. Dept. of Chemistry.
For primary bibliographic entry see Field 4A.
W79-08624

ADVANCES IN GROUNDWATER HYDROLOGY,
Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory,

Minneapolis, Minnesota, September 1976. 341 p. Saleem, Z. A., editor. Cost $15.00.

Descriptors: *Groundwater, *Conferences, *Porous media, *Surface-groundwater relationships, *Model studies, Hydrology, Water law, Groundwater recharge, Water management(Applied), Wells, Computer models, Saline water intrusion, Aquifers, Education, Training, Groundwater movement, Aquifer characteristics, Water quality, Hydraulics, Flow, Pollutants, Analytical techniques, Numerical analysis, Geochemistry, Mathematical models.

The objective of this symposium was to discuss and review advancements in groundwater hydrology. The following aspects of groundwater hydrology were discussed: groundwater law, education, and management; groundwater movement and well hydraulics; salt water intrusion; artificial recharge and surface water/groundwater relations; aquifer parameter identification; interaction of groundwater with porous media; and computer models. (See W79-08632 thru W79-08656) (Humphreys-ISWS)
W79-08631

AN INTRODUCTION TO ADVANCES IN GROUNDWATER HYDROLOGY,
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
Z. A. Saleem.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 2-6, September 1976. 33 ref.

Descriptors: *Groundwater, *Education, *Institutions, *Reviews, *United Nations, *United States, Publications, Research priorities, Governments, Universities.

Advances in groundwater science and technology in response to the growing demand for groundwater in recent years have been astonishing due to many reasons including: the intensive efforts of the national and international organizations concerned with surface and groundwater resources; active roles of the Congress and the Federal and State governments; and the impact of modern science and technology. Advances have been made in all aspects of groundwater hydrology including: understanding of complex groundwater systems; techniques and capabilities for analyses of complex problems and solutions of several complex problems; the quality and quantity of data concerning groundwater resources and the storage and retrieval of data; the rise in the quality and quantity of educational opportunities and publications related to groundwater hydrology; and the overall awareness of the significance of groundwater as a slowly renewable natural resource. However, there still are many areas where improvements and greater advances can be made. Advances must be made in better understanding of interactions of groundwaters with subsurface environments. The physico-chemical responses of aquifer systems to a variety of natural and artificial stresses need to be further investigated, for example, stresses due to heat storage well systems and due to the underground pumped hydro-storage systems. The long-range regional adverse effects of stresses on groundwaters and on the subsurface environments need to be further investigated. Policies for the long range optimal conjunctive use of surface and groundwater resources of regional areas should be determined. There is definite need for better data so as to refine predictions of effects on the extraction of groundwaters and of the use of subsurface environment for liquid waste disposal and for other purposes. (See also W79-08631) (Humphreys-ISWS)
W79-08632

PROGRESS IN RESEARCH ON WELL HYDRAULICS,
Rice Univ., Houston, TX. Dept. of Geology.
T. D. Streltsova.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 15-28, September 1976. 103 ref.

Descriptors: *Wells, *Hydraulics, *Aquifers, *Mathematical models, Model studies, Underflow, Steady flow, Unsteady flow, Groundwater movement, Theoretical analysis, Analytical techniques, Reviews, Flow, Equations, Aquifer characteristics, Leaky aquifers.

Exploration and development of underground natural resources are closely associated with advances in well hydraulics. Much of the recent research has been concentrated on improving the understanding of the phenomenon of fluid flow towards a pumping well. Detailed theoretical studies have been undertaken for the flow in all the basic reservoir formations: confined, unconfined, leaky, aquifer-aquitard, and fractured, with account being taken of the compressibility and anisotropy of the aquifer, the partial penetration of the abstraction well, well-bore storage, the depth at which the drawdown in an observation well is measured, and the saturated and unsaturated zones above the water table. Advances in computer technology have facilitated solutions using highly sophisticated analytical methods, application of which will enlarge the scope in planning and development of the well fields. Though the present review emphasized the recent advances in well hydraulics, the earlier work was also included where needed to provide the necessary background. Some general differential equations for the underground flow and the main assumptions were given to retrace the general approach in well hydraulics study. Consideration was mainly concerned with the unsteady state flow developments. (See also W79-08631) (Humphreys-ISWS)
W79-08634

A REVIEW OF THE INTEGRODIFFERENTIAL EQUATIONS APPROACH TO LEAKY AQUIFER MECHANICS,
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. of Applied Mathematics.
I. Herrera.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 29-47, September 1976. 5 fig, 1 tab, 15 ref.

Descriptors: *Aquifers, *Groundwater, *Mathematical models, *Theoretical analysis, Model studies, Reviews, Analytical techniques, Flow, Groundwater movement, Equations, Hydraulics, Drawdown, Numerical analysis, Leaky aquifers.

The integrodifferential equations approach to leaky aquifer mechanics has been developed as part of a program of research which is being carried out at the National University of Mexico. In this paper, a review of this theory in its present state of development was presented. First, the integrodifferential equations formulation was given. Then, approximate theories were derived by developing approximations of the memory and influence functions. A critical discussion of these theories was included, from the point of view of its adequacy for numerical treatment. An exact numerical method was presented, and its advantages over standard methods were exhibited. An application of the integrodifferential equations to carry out error analysis was also explained. (See also W79-08631) (Humphreys-ISWS)
W79-08635

ADVANCES AND UNCERTAINTIES IN THE STUDY OF GROUNDWATER FLOW IN FISSURED ROCKS,
Rice Univ., Houston, TX. Dept. of Geology.
T. D. Streltsova.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 48-56, September 1976. 51 ref.

Descriptors: *Groundwater, *Fissures(Geologic), *Flow, *Model studies, Fracture permeability, Risks, Fractures(Geologic), Reviews, Mathematical models, Analytical techniques, Porous media, Groundwater movement, Unsteady flow, Drawdown, Pumping, Porosity, Permeability, Fissured rocks.

Analytical attempts to take account of the effect of fracturing are associated with representation of the fissured rock masses by models to which a continuity approach may be applied. Two such basic conceptual models were considered. The first one represents so-called 'double-porosity' media, consisting of block masses of primary porosity separated from each other by many randomly distributed and oriented fissures. The second model represents a porous medium containing aligned flat fissures of high permeability extending horizontally, with an additional possible system of vertical fractures. Discussion on developments of these models and their relation was given. The behavior of the fluid flow in response to a pressure change due to pumping is characterized for the two constituents of a fractured formation: fissures and porous blocks. The fissure and the porous block drawdowns were discussed for the cases when compressibility, transmissibility, and relative sizes of both the porous blocks and their adjoining fissures are taken into account. Vertical and horizontal flow components are assumed in a fissure as well as in a block. The fissure-porous block flow exchange was shown to have a change of sign across the fissure-block boundary with the effect that in a certain region adjacent to the pumped well the water head recordings will indicate an initial increase of the water pressure in response to pumping. The behavior of an unconfined fissured aquifer was also discussed. Determination of the geometry and hydraulic properties of a fractured rock mass, specification of the formation constants for a fractured aquifer, and development of methods for the analysis of pumping test data are the objectives of further study. (See also W79-08631) (Humphreys-ISWS)
W79-08636

STOCHASTIC ANALYSIS OF FLOW IN AQUIFERS,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
L. W. Gelhar.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 57-71, September 1976. 11 fig, 10 ref.

Descriptors: *Aquifer systems, *Groundwater movement, *Model studies, *Stochastic processes, Flow, Mathematical models, Analytical techniques, Synthetic hydrology, Variability, Spatial distribution, Dispersion, Statistical methods, Water levels, Hydraulic conductivity, Aquifer characteristics, Groundwater recharge, Natural recharge, Water table.

Although groundwater flow has traditionally been modeled in a deterministic sense, the perspective of stochastic processes is becoming more widely adopted to describe the phenomenon. Recent work was summarized in which this approach has been used to characterize the temporal variability which, for example, is associated with natural recharge, and the spatial variability, introduced because of the permeability structure of natural deposits. Time series analysis of groundwater levels and precipitation illustrate the filtering effect of groundwater systems. The use of frequency spectra and transfer functions to estimate aquifer parameters was illustrated, and current work using similar techniques to estimate groundwater recharge was described. Field data demonstrated that hydraulic conductivity varies from point to point in aquifers. Several continuum analyses of spatial flow effects were summarized, based on spectral analysis in the wave number domain. Applications to flow network design and dispersive mixing analysis were discussed. The results showed that the effect of multidimensional flow perturbations is significant. (See also W79-08631) (Humphreys-ISWS)
W79-08637

A SYSTEMATIC OPTIMIZATION PROCEDURE FOR THE IDENTIFICATION OF INHOMOGENEOUS AQUIFER PARAMETERS,
California Univ., Los Angeles. Dept. of Engineering Systems.
W. W-G. Yeh, and Y. S. Yoon.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 72-82, September 1976. 3 tab, 22 ref.

Descriptors: *Aquifer characteristics, *Groundwater, *Heterogeneity, *Mathematical models, Aquifers, Analytical techniques, Optimization, Model studies, Variability, Unsteady flow, Groundwater movement, Transmissivity, Spatial distribution, Statistical methods.

This paper developed a systematic optimization procedure for parameter identification in an inhomogeneous aquifer system. The parameters to be identified are the transmissivities, and identification was based upon scattered observations of head variations within the system. The procedure attempts to improve the method of subdividing a given inhomogeneous system into piecewise homogeneous subregions. Each subregion is characterized by a single parameter. During the optimization process, the covariance matrix of the unknown parameters associated with each of the subregions is estimated and used as a measure to identify whether parameters are well-determined or ill-determined. An ill-determined parameter is characterized by the estimate having a large variance. Subdividing is refined only around the well-determined parameters, while coarse grids are used around the ill-determined parameters. A constrained least-squares method is used for optimization. Numerical examples were carried out which demonstrates the validity of the procedure, especially for predictional purposes. For a given aquifer system with given quantity and quality of data, the proposed method enables the determination of an optimum trade-off between the least-squares error and system characterization. The dimension and configuration of the parameter space are determined based upon whether the estimated parameters are well-determined or ill-determined. The method developed is extremely useful when the geometric subdivisions of parameters are unknown. (See also W79-08631) (Humphreys-ISWS)
W79-08638

THE AM-FM CONCEPT IN PARAMETER IDENTIFICATION,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. P. Neuman, and U. Kafri.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 83-101, September 1976. 5 fig, 12 ref.

Descriptors: *Groundwater movement, *Mathematical models, *Groundwater, *Theoretical analysis, Model studies, Analytical techniques, Risks, Finite element analysis, Mathematical studies, Water levels, Water table, Aquifers, Optimization, Linear programming, Quadratic programming, Inverse problem.

A theoretical analysis of the inverse problem associated with the Boussinesq equation of groundwater flow indicated that the solution to this problem is often non-unique and unstable. In particular, low-amplitude errors in the data may cause severe spatial osciallations in the parameters of the model, thereby making it impossible to solve the inverse problem by classical mathematical methods. In order to obtain a meaningful solution, it is necessary to control (or modulate) the frequency and amplitude of these oscillations in a systematic manner. This can be accomplished by defining appropriate 'regularization' criteria and then gradually varying their magnitude with the aid of parametric linear and quadratic programming or by other techniques. The degree to which the parameters must be regularized by modulating their frequency and amplitude reflects the degree of resolution that can be achieved with a given set of data. Previously published theoretical examples together with recent preliminary results from the Cienega Basin near Tucson, Arizona, indicated that the AM-FM concept is highly promising. (See also W79-08631) (Humphreys-ISWS)
W79-08639

ADVANCES IN GROUNDWATER FLOW MODELING,
Illinois State Water Survey, Urbana.
T. A. Prickett.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 102-112, September 1976. 52 ref.

Descriptors: *Groundwater movement, *Model studies, *Computers, *Reviews, *Groundwater, Hydraulic models, Mathematical models, Flow, Computer models, Analog models, Research and development, Finite element analysis, Analytical techniques, Finite difference models.

An outline of groundwater 'flow' modeling techniques was given. This contrasts with groundwater 'transport' modeling which is reported elsewhere at this symposium. A brief background of each technique within the categories of mathematical, sand tank, analog, and numerical models was given. Special emphasis was given to techniques developed since 1970. Further attention was given to the set of references cited in that they each contain the three elements of theory, documented model descriptions or computer codes, and practical applications. The report concluded with a brief description of available computer equipment and its implication on future model development. It is the author's opinion that the advance realized in groundwater modeling since 1970 has been mainly due the world-wide availability of digital computers. The number of computer centers is large. However, the trend seems to be from the central computer facility to the decentralized type of operation. Remote terminal operation by ordinary telephone line is commonplace, the relatively low cost minicomputer is becoming a reality, and the microprocessor, in the form of hand-held types, is now becoming reasonable in price. This is leading to more advances in numerical techniques for groundwater flow modeling, especially for small computer systems. (See also W79-08631) (Humphreys-ISWS)
W79-08640

NUMERICAL SIMULATION OF CONTAMINANT TRANSPORT IN SUBSURFACE SYSTEMS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W79-08641

THE FINITE ELEMENT METHOD IN GROUNDWATER TRANSPORT,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-08642

DISPERSION IN NON-UNIFORM AND ANISOTROPIC POROUS MEDIA,
Shell Development Co., Houston, TX.
M. B. Moranville, D. P. Kessler, and R. A. Greenkorn.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 173-186, September 1976. 4 fig, 1 tab, 28 ref.

Descriptors: *Groundwater movement, *Mathematical models, *Reviews, *Porous media, Stochastic processes, Model studies, Flow, Dispersion, Permeability, Diffusion, Aquifers, Statistical models, Anisotropy, Continuum models, Phenomenological models.

This paper reviewed continuum models, statistical models, and phenomenological models for the description of flow in porous media. Both permeability and dispersion were treated. The effect of non-uniformity on dispersion and the effect of anisotropy on dispersion were both specifically treated using a stochastic model based on a random ensemble of idealized pores distributed according to some joint probability density function. For a homogeneous medium, the dispersion tensor was calculated in terms of single step averages, and then this form was considered for particular probability density distributions--specifically, delta functions, uniform distributions, and exponential distributions. Results were compared with laboratory measurements in unconsolidated media. (See also W79-08631) (Humphreys-ISWS)
W79-08645

DESIGNING A MODEL FOR DEEP-LYING PORE FLUIDS,
Illinois Univ. at Urbana-Champaign. Dept. of Geology.
D. L. Graf, and D. E. Anderson.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 187-198, September 1976. 32 ref, 1 append. NSF GA-21156, GAR 76-13565.

Descriptors: *Porous media, *Flow, *Thermodynamic behavior, *Geophysics, Entropy, Heat flow, Diffusion, Thermodynamics, Groundwater, Osmosis, Geothermal studies.

The accumulated experience of groundwater hydrologists in modeling fluid flow through porous media is finding new application in studies of petroleum migration, ore deposition, and geothermal power development at depths where the pore fluids are hot and highly saline. Chemical reactions, heat flow, diffusion of dissolved substances, and the osmotic phenomena associated with cross-formational transport through shales will often be more important in this environment than the flow of bulk flow fluid laterally through a particular formation. Nonequilibrium thermodynamics is attractive for treating these complex systems because of its theoretical breadth, and because the entropy production and entropy balance equations developed in this approach make it possible to tell whether a given system is moving toward an equilibrium state or a steady state with time. The assumption of linearity between thermodynamic forces and fluxes required in classical nonequilibrium thermodynamics is moderately in error for diffusion coefficients, which are concentration-dependent in these brines, and is in considerable difficulty for chemical reactions, which typically proceed far enough from equilibrium to be outside the region of linear behavior. A more general nonlinear model is being sought by workers in continuum mechanics, engineering transport studies, and nonequilibrium thermodynamics. (See also W79-08631) (Humphreys-ISWS)
W79-08646

IDENTIFICATION OF GEOCHEMICAL PATTERNS IN GROUNDWATER BY NUMERICAL ANALYSIS,
Suwannee River Water Management District, White Springs, FL.
For primary bibliographic entry see Field 5B.
W79-08647

MIGRATION OF LANDFILL LEACHATE THROUGH UNCONSOLIDATED POROUS MEDIA,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 5B.
W79-08648

THEORETICAL DEVELOPMENTS AND PRACTICAL NEEDS IN THE FIELD OF SALT WATER INTRUSION,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.

W79-08649

RELATIONSHIPS BETWEEN SMALL WATER BODIES AND GROUNDWATER,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 2A.
W79-08650

REPRESENTING STREAM AQUIFER INTERACTION,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
W. E. Kelly.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 262-270, September 1976. 6 fig, 15 ref.

Descriptors: *Surface-groundwater relationships, *Streams, *Groundwater movement, *Aquifer systems, Analytical techniques, Analysis, Model studies, Analog models, Mathematical models, Pumping, Water wells, Groundwater, Theoretical analysis.

A comparison of theoretical solutions for the response of infinite and semi-infinite homogeneous aquifers with fully penetrating streams suggested that, at any point, the response to a step change in stream stage may be used to predict the rate of stream depletion due to a step change in pumping rate at the same point. This was tested on an idealized stream-aquifer system and digital and analog models of an actual stream-aquifer system. Results demonstrated that rates of stream depletion due to pumping may be determined rapidly in digital and analog models by determining the aquifer response to stream stage changes. (See also W79-08631) (Humphreys-ISWS)
W79-08651

INTERTEMPORAL CONTROL OF GROUNDWATER IN MULTIAQUIFER MODELS,
Montana State Univ., Bozeman. Dept. of Agricultural Economics and Economics.
For primary bibliographic entry see Field 6A.
W79-08653

A MANAGEMENT MODEL FOR DETERMINING EFFLUENT STANDARDS FOR THE ARTIFICIAL RECHARGE OF MUNICIPAL AND INDUSTRIAL WASTEWATERS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5E.
W79-08654

STOCHASTIC MANAGEMENT OF A STREAM-AQUIFER SYSTEM,
Universidad Nacional Automona de Mexico, Mexico City. Inst. de Geofisica.
For primary bibliographic entry see Field 6A.
W79-08655

FLOW TO WATER-TABLE WELLS DERIVING THEIR DISCHARGE FROM CAPTURE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08656

MAP SHOWING GROUND-WATER CONDITIONS IN THE KAIBITO AND TUBA CITY AREAS, COCONINO AND NAVAJO COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08688

MAP SHOWING GROUND-WATER CONDITIONS IN THE VIRGIN RIVER, GRAND WASH, AND SHIVWITS AREAS, MOHAVE COUNTY, ARIZONA--1976,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-08689

WATER RESOURCES OF THE SANTA YNEZ INDIAN RESERVATION, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-08698

2G. Water In Soils

STATISTICAL RELATIONSHIPS OF WATER FLOW PARAMETERS WITH SOIL MATRIX AND POROSITY PROPERTIES,
Indian Agricultural Research Inst., New Delhi. Div. of Agricultural Physics.
V. Murali, G. S. R. Krishna Murti, and A. K. Sinha.
Journal of Hydrology, Vol. 41, No. 3/4, p 371-376, May 1979. 4 tab, 9 ref.

Descriptors: *Soil water movement, *Statistical models, *Unsaturated flow, *Hydraulic conductivity, *Porosity, Correlation analysis, Soil properties, Iron oxides, Soil texture, Organic matter, Pores, Model studies, *India, Pore size distribution.

Relationships of the water flow parameters with two sets of soil characteristics were analysed statistically for 20 soils of India. Hydraulic conductivity and soil water diffusivity at different moisture levels covering a wide range of field moisture regime were found to be strongly influenced by the matrix properties--texture, organic matter, free iron oxide--and by the pore size distribution of the soils. (Visocky-ISWS)
W79-08564

PORE SIZE DISTRIBUTION--A FACTOR TO BE CONSIDERED IN INFILTRATION STUDIES,
University Coll., London (England). Dept. of Geography.
S. W. Baker.
Journal of Hydrology, Vol. 41, No. 3/4, p 279-290, May 1979. 2 fig, 2 tab, 17 ref.

Descriptors: *Pores, *Infiltration, *Size, *Soil properties, *Distribution, Interstices, Hydraulic conductivity, Soil moisture, Capillary action, Model studies, Annelids, Statistical methods, Correlation analysis, Infiltrometers, Colloids, Path analysis, Swelling, Clay content.

Pore size distribution (PSD) is often mentioned as an important factor controlling the rate of infiltration into a soil, but surprisingly when it comes to quantitative assessment or prediction of infiltration rates, PSD is rarely considered. Four possible reasons were suggested to explain this paradox: (1) the difficulties of isolating PSD from the entanglement of variables that control infiltration rates; (2) the variability of PSD through time; (3) measurement problems; and (4) the difficulty of expressing PSD as a single-term index which is suitable for any subsequent analysis. An attempt was made to construct a suitable index of pore size distribution, and then to include this in a path analysis study to examine the variable structure between infiltration, PSD, and a number of additional explanatory variables. (Visocky-ISWS)
W79-08569

SIMULTANEOUS TRANSPORT OF WATER AND REACTING SOLUTES THROUGH MULTILAYERED SOILS UNDER TRANSIENT UNSATURATED FLOW CONDITIONS,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
A. B. Gureghian, D. S. Ward, and R. W. Cleary.
Journal of Hydrology, Vol. 41, No. 3/4, p 253-278, May 1979. 17 fig, 1 tab, 45 ref. EPA P-002103-01-0.

Descriptors: *Ion transport, *Dispersion, *Soil water movement, *Unsaturated flow, Unsteady flow, Solutes, Numerical analysis, Computer models, Fertilizers, Ammonium compounds, Chemical reactions, Infiltration, Evaporation, Soil properties, Hydraulic properties, Mass transfer, Equations, Nitrification, Adsorption, Hydraulic conductivity, Model studies, *Multilayered soils, Finite-difference methods, Mass transport.

A one-dimensional, unsteady-state numerical model for the simultaneous movement of water and multisolutes through multilayered soil systems under unsaturated flow conditions was presented. The multilayered system was represented as a series of homogeneous layers, and a two-step implicit finite-difference method was used to solve the resulting set of flow equations. The solute equation was solved by the Crank-Nicolson method. For illustrative purposes, one of the multisolute systems considered was an ammoniacal agricultural fertilization problem in which the sequential chemical reaction of ammonium going to nitrite, going to nitrate was described by first-order kinetics with linear adsorption of ammonium. In addition, a nonlinear adsorption isotherm was used to illustrate the effects of single solute adsorption in a multilayer sequence. Of considerable interest to those involved in the disposal of wastes on land is the effect of the layering sequence (coarse-fine-coarse vs. fine-coarse-fine) on the final outlet concentration. The pressure based model considers both infiltration, redistribution and evaporation. Cubic spline functions are used to define the soil hydraulic properties. (Visocky-ISWS)
W79-08570

HYDROLOGICAL APPLICATIONS OF NOBLE GASES AND TEMPERATURE MEASUREMENTS IN UNDERGROUND WATER SYSTEMS: EXAMPLES FROM ISRAEL,
Weizmann Inst. of Science, Rehovot (Israel).
O. Herzberg, and E. Mazor.
Journal of Hydrology, Vol. 41, No. 3/4, p 217-231, May 1979. 5 fig, 8 tab, 9 ref.

Descriptors: *Argon, *Groundwater, *Hydrologic cycle, *Geothermal studies, *Tracers, Gases, Temperature, Springs, Karst, Recharge, Saturated flow, Circulation, Aquifers, *Noble gases, *Israel, Krypton, Xenon, Paleotemperature.

The observations on the behavior of the noble gases in the hydrological cycle may provide the tools to calculate the initial noble-gas contents in recharging water. This is essential for: (1) the use of the noble gases as tracers in geothermal systems; and (2) the evaluation of initial noble-gas contents in ancient waters for paleotemperature studies. Noble-gas contents in four non-karstic and three karstic springs were repeatedly measured, along with the temperatures in the recharge and discharge points. The Ar, Kr, and Xe contents in non-karstic springs were found to reflect the temperature of the base of the aerated zone above the water table. This temperature was seen to be close to the local average annual temperature and different from the rainy season temperature. The difference between the temperature measured at a spring and the noble-gas-deduced temperature indicates the depth of circulation in the saturated aquifer, and thus may enable one to recognize the recharge area (e.g., local rain or recharge from adjacent mountains). Karstic springs were found to contain substantial air excesses, revealing a negative correlation to discharge. (Visocky-ISWS)
W79-08571

SOME OBSERVATIONS ON THE PERIODIC VARIATIONS OF MOISTURE IN STABILISED AND UNSTABILISED SAND DUNES OF THE INDIAN DESERT,
Central Arid Zone Research Inst., Jodhpur (India).
J. P. Gupta.
Journal of Hydrology, Vol. 41, No. 1/2, p 153-156, April 1979. 1 fig, 1 tab, 3 ref.

Descriptors: *Soil moisture, *Dune sands, *Deserts, Moisture uptake, Hydrology, Rainfall, Dunes, Foreign countries, Foreign research, Trees, Grasses, Particle size, *India, Moisture profile

During 1974-1976, the dynamics of moisture was studied in stabilized and unstabilized sand dunes of the Bikaner region. Maximum moisture in both the stabilized and unstabilized sand dunes was observed during the rainy season. At the end of the dry season, during the period of peak evaporation, i.e. June, the unstabilized sand dunes still contained an average of 2-5% moisture at 30-180 cm depth compared to 1% or less in the stabilized dunes. At this time of the year, the total profile moisture storage in the unstabilized dunes varied from 50 to 70 mm, while in the stabilized dunes it ranged from 12 to 23 mm. (Lee-ISWS)
W79-08573

THE SENSITIVITY OF PARAMETERS IN THE PENMAN EVAPORATION EQUATIONS AND DIRECT RECHARGE BALANCE,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2D.
W79-08618

COMPARISON OF DIFFERENT METHODS FOR MEASURING SOIL SALINITY UNDER FIELD CONDITIONS,
Indian Agricultural Research Inst., New Delhi. Water Technology Center.
For primary bibliographic entry see Field 7B.
W79-08757

2H. Lakes

THE SUMMER CONDITION OF THREE EASTERN TRANSVAAL RESERVOIRS AND SOME CONSIDERATIONS REGARDING THE ASSESSMENT OF TROPHIC STATUS,
National Inst. for Water Research, Pretoria (South Africa).
R. D. Walmsley, and D. F. Toerien.
Journal of the Limnological Society of South Africa, Vol. 3, No. 2, p 37-41, 1977. 4 fig, 2 tab, 18 ref.

Descriptors: *Reservoirs, *Trophic level, Aquatic algae, Aquatic habitats, Hypolimnion, Limnology, Reservoir stages, Da Gama Reservoir, Klipkopje Reservoir, Witklip Reservoir, Chemical properties, Aquatic environment, Light penetration, Chlorophyll a, Mesotrophy, Eutrophication, South Africa.

Limnological data on the late summer conditions of the Da Gama, Klipkopje, and Witklip reservoirs is given and discussed. Temperature and oxygen profiles, light penetration characteristics, chlorophyll a content, and algal growth potential (AGP), were determined for each reservoir. Water samples from different depths were analyzed for various chemicals and properties. The water column showed distinct layering. Secchi disc transparency appeared to be at a depth of about 5-10% of the light intensity of the surface. Chemical analyses showed waters from all three reservoirs to be acidic. Bottom waters had lower pH values than surface waters; conductivity and alkalinity values were much higher at the bottom. AGP increased with depth of the sample for all three reservoirs. Nitrogen was shown to be the growth limiting factor for some algae in all three reservoirs. In all, chlorophyll a concentrations showed that phytoplankton populations were not unduly high. Transparency in the three may be regulated by chlorophyll a context, rather than by quantities of suspended clay as in other South African reservoirs. Temperature stratification was not classical for this type of water body. The waters of the three may be classified as soft acidic waters. Stratification was stable and typical of a eutrophic condition. The three reservoirs can be tentatively classified as mesotrophic. (Schaefer-IPA)
W79-08504

LAKE MCILWAINE AFTER TWENTY-FIVE YEARS,
Department of National Parks and Wild Life Management, Salisbury (Rhodesia).
B. E. Marshall.
Rhodesia Science News, Vol. 12, No. 3, p 79-82, March 1978. 5 fig.

Descriptors: *Lake morphology, Water pollution, Lake McIlwaine, Rhodesia, Artificial lakes, Limnology, Lake sediments, Recreation facilities, Lakes, Eutrophication, Aquatic algae, Nuisance algae, Nutrients, Fish.

Lake McIlwaine, a man-made lake created in 1952 with a surface area of 2630 ha is examined. It is the first African Lake to experience artificial eutrophication, a feature associated with lakes in industrialized northern countries. Serious algal blooms first appeared in 1960. The situation has become increasingly severe, but diversion of sewage effluent to irrigation of land has caused a decline in the nutrient level. The lake waters are thermally stratified. In the summer, large quantities of nutrient are trapped in the anaerobic bottom waters; the lake becomes isothermal in the winter and trapped nutrients are released and stimulate algal growth. The phytoplankton consists almost entirely of blue-green algae. Tilapia and algae blooms may have inhibited macrophytes. Benthic fauna are important as consumers of organic sediments and as fish food. Only seven of the 25 species of fish occurring in the lake are important commercially or for angling. Total fish production is about 250-300 tonnes/yr. Inorganic pollution is not yet a serious problem, but should be closely watched. (Schaefer-IPA)
W79-08506

WATER EUTROFICATION--A 20TH CENTURY PROBLEM (PART II),
National Inst. for Water Research, Pretoria (South Africa).
J. Hemens.
Chemsa, Vol. 3, No. 12, p 201-203, December 1977. 1 fig, 4 ref.

Descriptors: *Eutrophication, *Nutrient removal, *Phosphorus, South Africa, Water properties, Nutrients, Lakes, Dams, Fertility, Biocontrol, Toxins, Water quality control, Water treatment, Harvesting.

The physical, chemical, and biological methods that have been used to reduce or prevent eutrophication are described. Probably the most effective, and hence most desirable long term approach is to control the influx of nutrients of a lake. Most nutrient limitation programs have been concerned with the limitation of phosphorus since it is most often the critical nutrient. The time required to organize and implement this approach may be lengthy so other quicker methods which accelerate nutrient outflow or prevent internal recycling are used, even though they usually provide only temporary relief. In-lake control methods seek to manipulate the sediment in various ways because of the important role of sediments. Dredging, dilution or flushing, selective discharge, nutrient precipitation and inactivation, harvesting the plant or fish production of lakes and dams, and use of algicides and herbicides are possible approaches to reducing nutrient concentrations. Almost all methods involve considerable effort and expense. There is no effluent standard for phosphorus in South Africa; consideration is now being given to the need for one. Addition of metal ions at a suitable stage in sewage treatment plants and microbiological activity to incorporate phosphorus into cell tissue are being examined as methods of phosphorus removal in South Africa. (Schaefer-IPA)
W79-08508

THE LIMNOLOGY OF SOME SOUTH AFRICAN IMPOUNDMENTS, PART I: THE PHYSICO-CHEMICAL LIMNOLOGY OF HARTBEESPOORT DAM,
National Inst. for Water Research, Pretoria (South Africa).
W. E. Scott, M. T. Seaman, A. D. Connell, S. I. Kohlmeyer, and D. F. Toerien.
Journal of the Limnological Society of South Africa, Vol. 3, No. 2, p 43-58, 1977. 27 fig, 23 tab, 30 ref.

Descriptors: *Hartbeespoort Dam, *Physicochemical properties, Limnology, Hypolimnion, Limnology, Lakes, South Africa, Impoundments, Aquatic environment, Eutrophication, Oligotrophy, Water properties, Chemical analysis, Nutrients, Nitrogen, Phosphorus, Turnovers.

Comparison of recently-obtained physico-chemical limnological data and results of earlier studies indicate changes accompanying the metamorphosis of the Hartbeespoort Dam from oligotrophic to eutrophic condition. Water transparency, temperature, oxygen concentrations, and pH were determined in situ. Chemical analyses, conductivity studies, algal bioassays, and identification of growth limiting nutrients were carried out in the laboratory. Statistical analyses evaluated differences in concentrations of chemicals at sampling stations. Results obtained regarding the volume of water in the dam, the light regime, temperature studies, including the volume of water in the dam, the light regime, temperature studies, including isotherms for the six sampling stations, and oxygen isopleths for the sampling stations are given. The concentrations of ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, organic nitrogen, total nitrogen, orthophosphate phosphorus, total phosphorus, sodium, silica, potassium, calcium, magnesium, chloride, and sulphate are detailed. Alkalinity, chemical oxygen demand, methylene-blue active substances, and algal growth potential are discussed. The lake was shown to be warm, monomictic, and alkaline with high levels of nitrogen and phosphorus. Overturn is in April. The pH and mineral content have increased over the last 50 years; phosphate concentrations have increased about one hundred fold during that period. (Schaefer-IPA)
W79-08509

INSTITUTE FOR FRESHWATER STUDIES, RHODES UNIVERSITY.
Scientiae, Vol. 18, No. 4, p 35-37, October-December 1977. 3 fig.

Descriptors: *Lake Sibaya, *Lake Swartvlei, *Lake morphology, South Africa, Lakes, Aquatic habitats, Balance of nature, Limnology, Ecology, Hydrobiology, Cycles.

Studies conducted by the Institute for Freshwater Studies at Rhodes University on the ecological structure of South Africa's coastal lakes are discussed. The lakes were formed during the last great northern hemisphere glaciation in the Pleistocene era about 25,000 years ago. Faunal elements commonly found in South African estuaries today provide a clue to the estuarine origin of these lakes. Investigations suggest that cycles of elevated salinity are naturally occurring aperiodic or irregular cycles caused by such factors as fluctuations of rainfall and inflow into the lake, and not necessarily by man's activities. The pattern of interactions between the main plant and animal components of a lake can be sorted out due to the relative simplicity of the ecological structure of the lakes, and in particular, Lake Sibaya. At Lake Sibaya, the importance of the extensive shallow terrace to the growth and reproduction of the cichlid fish Sarotherodon mossambicus was studied. At Lake Swartvlei, hydrobiological studies centered mainly on the structure of rooted water plant communities and their role in the hydrochemical processes in the lake, particularly the uptake and translocation of phosphorus. (Schaefer-IPA)
W79-08512

FISHES OF THE KOSI SYSTEM,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W79-08518

THE POST-IMPOUNDMENT ICHTHYOFAUNA OF THE J. G. STRIJDOM DAM, KWAZULU,
Natal Univ., Pietermaritzburg (South Africa).
H. M. Kok, S. J. M. Blaber, and G. C. B. Walley.
South African Journal of Science, Vol. 74, No. 4, p 140-142, April 1978. 2 fig, 4 tab, 13 ref.

Descriptors: *Fish populations, *Dams, Impoundments, Fish types, Aquatic animals, Fish, Wildlife,

J G Strijdom Dam, South Africa, Aquatic habitats, Spawning, Fish reproduction, Pongolo River.

The species composition, faunal changes that have occurred in the J. G. Stijdom Dam since its closure, and the adaptation of rheophilic fish species to the lacustrine conditions in the dam were studied. In 1976, fish samples were taken in three monthly samples using gill nets, fry nets, and floodplain pans. Results show not only that the species composition changed from 1969, (the dam commenced filling in 1970) to 1976, but that there appears to be a differential distribution of species in the dam as predicted in earlier studies. Two major faunal changes were the absence of E. depressirostris, M. macrolepidotus, and Alestes imberi from the 1969 catches and the absence of Hydrocynus vittatus and Barbus marequensis from the 1976 catches. There was a noticeable change in the reversal in abundance of the two Labeo species, L. rosae and L. rubropunctatus. The first is a benthic detritus feeder while the second prefers aufwuchs, and differential production rates of the selected food types may be favoring the second species. (Schaefer-IPA)
W79-08521

PRODUCTIVITY AND NUTRIENT EXPORT STUDIES IN A CYPRESS SWAMP AND LAKE SYSTEM IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2I.
W79-08545

HYDROGEOLOGY OF THE LESSER SLAVE LAKE AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 2F.
W79-08551

MODEL AND OBSERVED CIRCULATION THROUGHOUT THE ANNUAL TEMPERATURE CYCLE OF LAKE MICHIGAN,
Argonne National Lab., IL. Energy and Environmental Systems Div.
J. H. Allender, and J. H. Saylor.
Journal of Physical Oceanography, Vol. 9, No. 3, p 573-579, May 1979. 6 fig, 1 tab, 12 ref.

Descriptors: *Circulation, *Lake Michigan, *Great Lakes, *Temperature, *Heat budget, *Mathematical models, Lakes, Currents(Water), Current meters, Heat flow, Wind velocity, Model studies, *Model verification, Temperature distributions, Model sensitivity, Wind stress.

Monthly average currents and temperatures predicted by a three-dimensional, numerical model of Lake Michigan were compared with observations made in that lake during June-October 1976. The observed data were from 17 current meters with integral temperature recorders that were concentrated on a transverse section of the southern basin of the lake. A brief interpretation of the overall aspects of these data was given, and the evolution of a deep temperature anomaly in the west-central basin was discussed. Model results were evaluated in terms of their comparability with the dominant features of the observed data. Lakewide-average temperatures in the model were reasonable, and the signs of the computed and observed currents showed some agreement. However, the model exaggerated upwelling along the upwind (western) shore, leading to temperature predictions that worsen progressively throughout the stratified season. The present study and other recent work suggest the need for improved mixed-layer physics in lake models. (Adams-ISWS)
W79-08554

ATMOSPHERIC ENHANCEMENT OF METAL DEPOSITION IN ADIRONDACK LAKE SEDIMENTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W79-08581

IMPORTANCE OF WETLAND TYPES TO DUCK PRODUCTION AND TO NON-GAME BIRD POPULATIONS,
South Dakota State Univ., Brookings. Dept. of Wildlife and Fisheries.
L. D. Flake, and P. A. Vohs, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 610, Price codes: A04 in paper copy, A01 in microfiche. South Dakota Water Resources Institute, South Dakota State University, Completion Report, April 1979. 50 p, 101 ref. OWRT B-045-SDAK(1), 14-34-0001-6118.

Descriptors: *Ducks(Wild), *Non-game birds, *Wetlands, Water birds, Game birds, Waterfowl, Wildlife, Aquatic habitats, Shallow water, Lakes, Ponds, Stock water, Animal populations, Streams, Dugouts.

South Dakota wetlands were studied to determine their importance to waterfowl and some wetland bird populations. Baseline data were obtained; using multivariate techniques habitat relationships of common species of waterfowl were examined. Useful information in assessing and mitigating potential water resource development was provided by both the baseline data and the habitat analysis data. Information on variables important to waterfowl use of man-made wetlands was obtained from close examination of duck use of stock ponds. Stock ponds and semipermanent wetlands contained proportionally more pairs of most species than other wetland categories. The habitat associated with pairs of each species were described using multiple regression and discriminant analyses. Habitat variables explained 35-47% and 26-35% of the variation in pairs having small and large home ranges respectively. Important variables associated with breeding pair use of stock ponds were emergent vegetation species, height, and interspersion. Non-game birds most frequently used glacial pond types. (Schaefer-IPA)
W79-08605

LAKE HURON WINTER CIRCULATION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. H. Saylor, and G. S. Miller.
Journal of Geophysical Research, Vol. 84, No. C6, p 3237-3252, June 20, 1979. 24 fig, 16 ref.

Descriptors: *Water circulation, *Winter, *Lake Huron, *Great Lakes, Current meters, On-site investigations, Temperature, Water temperature, Currents(Water), Circulation, Winds, Epilimnion, Lakes, Limnology, Climatology, Winter circulation.

Twenty-one current meter moorings were deployed in Lake Huron during winter 1974-1975. The moorings were set in November 1974 and retrieved approximately 6 months later. The stations were configured on a coarse grid to measure the lake-scale circulation during winter. Water temperature was also recorded in nearly all of the 65 current meters deployed. Results revealed a strong cyclonic flow pattern in the Lake Huron Basin persisting throughout the winter. The observed winter circulation was in essence very similar to what is now believed to be the summer circulation of epilimnion water, although the winter currents penetrated to deeper levels in the water column and were more intense. Winter cyclonic flow persisted in a nearly homogeneous water mass, while summer currents have been shown to exhibit an almost geostrophic balance with observed water density distributions. This suggests that the current field driven by prevailing wind stresses across the lake's water surface may be largely responsible for maintaining the horizontal gradients of water density observed in the lake during summer. Analyses of energetic wind stress impulses revealed the prevailing wind directions that drive the dominant circulations. When combined with results of summer surveys, the winter studies permit a description of the annual cycle of horizontal current speed variation with depth in Lake Huron. (Sims-ISWS)
W79-08614

GROUND-WATER INDUCED CHANGES IN LAKE CHEMISTRY,
University of South Florida, Tampa. Dept. of Chemistry.
For primary bibliographic entry see Field 4A.
W79-08624

RATE OF AVAILABILITY OF TOTAL PHOSPHORUS IN RIVER WATERS,
West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W79-08626

WATER-QUALITY RECONNAISSANCE OF LAKES IN VOYAGEURS NATIONAL PARK, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
G. A. Payne.
Geological Survey open-file report 79-556, 1979. 40 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Water quality, *Lakes, *Minnesota, *Eutrophication, *National parks, Nutrients, Phytoplankton, Cyanophyta, Algae, Oligotrophy, Water analysis, Chemical properties, Physical properties, Biological properties, Dissolved solids, Bottom sampling, *Voyageurs National Park(MN).

Water samples were collected from three lakes in Voyageurs National Park, MN., to assess chemical and biological water quality in March and August 1977. Bottom material samples also were collected and analyzed for chemical quality. Results of the analyses show that the water system was dilute; specific conductance ranged from 32 to 111 micromhos. Blue-green algae, particularly Oscillatoria, were the most common phytoplankton in the samples. Differences in water quality, shown particularly by concentrations of nutrients and dissolved solids, were detected between samples collected in different areas of the park. The collected data were used to design a monitoring program to assess eutrophication that may occur during the development of the park. (Woodard-USGS)
W79-08694

2I. Water In Plants

THE EFFECT OF THE METHOD OF IRRIGATION AND THE QUALITY OF THE WATER USED FOR SPRAYING ON THE INTENSITY OF RUSSETING IN GOLDEN DELICIOUS APPLES,
Fruit and Food Technology Research Inst., Stellenbosch (South Africa).
J. H. Terblanche, and P. R. Jolly.
Deciduous Fruit Grower, Vol. 26, Part 12, p 484-488, December 1976. 3 fig, 2 tab, 8 ref.

Descriptors: *Apples, *Russeting, *Irrigation effects, Irrigation practices, Pesticides, Fruit crops, Pome fruits, Orchards, Surface irrigation, Sprinkler irrigation, Irrigation water, Dams, Boreholes, Water quality.

The possibility that the quality of water used for irrigation and for spraying may have an effect on russeting of golden delicious apples was investigated. Four treatments were applied in a random block design with four replications: two by overhead and two by under-tree irrigation. Pesticide sprays with borehole and dam water were used with each style of irrigation. Overhead irrigation produced more severe russeting than under-tree irrigation. When overhead irrigation was applied there was only a slight difference in the effect of borehole and dam water; when under-tree irrigation was applied, dam water induced a considerably higher intensity of russeting than borehole water. Russeting was black or brown; black occurred only where overhead irrigation and/or sprays were applied using dam water. The dam water differed from the borehole water in that the former contained iron (more than 1 ppm) and was discolored brown due to the presence of dissolved organic acids; it is impossible to determine from available data if russeting was due to the separate

or combined effects of the iron and organic acids. (Schaefer-IPA)
W79-08513

PRODUCTIVITY AND DECOMPOSITION OF THE DOMINANT SALT MARSH PLANTS IN LOUISIANA,
Tulane Univ., New Orleans, LA. Dept. of Biology.
D. A. White, T. E. Weiss, J. M. Trapani, and L. B. Thien.
Ecology, Vol. 59, No. 4, p 751-759, Summer, 1978. 5 fig, 3 tab, 40 ref.

Descriptors: *Primary productivity, *Salt marshes, *Louisiana, *Rooted aquatic plants, Standing crops, Biomass, Vegetation, Marshes, Coastal marshes, Wetlands, Litter, Decomposing organic matter, Roots, Gulf Coastal Plain.

Live and dead standing crops were calculated by the harvest method over an annual cycle. Litterbags were used to estimate loss rates of vegetation from the marsh. Peak standing crops, in grams per square meter, were: Distichlis spicata, 1164; Spartina patens, 2194; Juncus roemerianus, 1959; and S. alterniflora, 1473. Net production estimates using the Smalley method, in grams per square meter per year, were: D. spicata, 1291; S. patens, 1342; J. roemerianus, 1740; and S. alterniflora, 1527. Using the Wiegert and Evans method, net production estimates, in grams per square meter per year, were: D. spicata, 1162; S. patens, 1428; J. roemerianus, 1806; and S. alterniflora, 2895. It is estimated that these four species produce 14,600,000 metric tons of plant material per year in Louisiana marshes. In general, production was higher for this Louisiana marsh than reported in Atlantic Coast marshes; decomposition rates were also considerably higher. (Stihler-Mass)
W79-08541

ESTUARINE PROCESSES, VOLUME I AND II.
For primary bibliographic entry see Field 2L.
W79-08543

FLUX OF ORGANIC MATTER THROUGH A SALT MARSH,
Georgia Univ. Athens.
L. R. Pomeroy, K. Bancroft, J. Breed, R. R. Christian, and D. Frankenberg.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 270-279. 1 fig, 1 tab, 39 ref.

Descriptors: *Organic matter, *Salt marshes, *Ecology, Marshes, Wetlands, Energy, Carbon, Carbon dioxide, Algae, Rooted aquatic plants, Aquatic life, Sediments.

The transfer of organic matter from primary producers through consumers to CO sub 2 in terms of quality and quantity of carbon compounds was examined for a salt marsh ecosystem. In addition to production of particulate material, sources of soluble carbon compounds which may be significant were found. These included losses from both living and dead macrophytes, primarily Spartina, from algae in water and sediments, from excretion and feces of consumers, and from biological processes in the sediments. Since Spartina detritus is relatively indigestible, much of the flux of organic matter to detritovores must involve conversion of particulate detritus to soluble compounds and their assimilation by microorganisms, which can then be consumed by detritovores. Some dissolved material accumulates as a film on the surface of the water and is formed into organic aggregates. Several lines of evidence suggest that microorganisms in the water actively assimilate dissolved organic material during the growing season. Microorganisms in the sediments, although they reside in a large pool of organic matter, appear to be substrate limited except near the sediment-water surface. (Stihler-Mass)
W79-08544

PRODUCTIVITY AND NUTRIENT EXPORT STUDIES IN A CYPRESS SWAMP AND LAKE SYSTEM IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
J. W. Day, T. J. Butler, and W. H. Conner.
In: Estuarine Processes, Volume II, Circulation, Sediments, and Transfer of Material in the Estuary, M. Wiley, editor, Academic Press, New York, N.Y., 1976, p 255-269, 6 fig, 2 tab, 32 ref.

Descriptors: *Primary productivity, *Nutrients, *Swamps, *Lakes, Forests, Wetlands, Estuaries, Biomass, Litter, Seasonal, Carbon, Nitrogen, Phosphorus, Ecology.

During a 14-month period in 1973-74, the productivity of two swamp forest components (bottomland hardwoods--BLH; baldcypress tupelo--CT), the productivity of lake and bayou waters, hydrology and carbon and nutrient export were studied in the upper drainage basin of the Barataria Bay estuary. Productivity of the BLH site was 800 g dry wt/sq m/yr for stem biomass increase, 584 for litterfall, and 200 for understory production. Similar figures for CT were 500, 620, and 20. Total above-ground net productivity was 1584 for BLH and 1140 for CT. Net daytime photosynthesis (NDP) for the lake was 1418 g O2/sq m/yr and nighttime respiration (NR) was 1868 (P/R = 0.76). For the bayous NDP was 316 and NR was 446 (P/R = 0.71). Water discharge from the basin is significant year-round except during the summer when evaporation equals precipitation. Annual export to the lower estuary (calculated from water discharge and materials concentrations) was 8016 metric tons of organic C, 1047 metric tons N, and 154 metric tons P. The greater part of this export occurred during the spring, corresponding to the spring peak in biological activity in the estuary. (Stihler-Mass)
W79-08545

MIDSUMMER STANDING CROPS OF WETLAND SEDGE MEADOWS ALONG A TRANSECT FROM FOREST TO PRAIRIE,
Minnesota Univ., St. Paul.
E. Gorham, and J. M. Bernard.
Journal of the Minnesota Academy of Science, Vol. 41, p 15-17, 1975. 1 fig, 2 tab, 14 ref.

Descriptors: *Wetlands, *Standing crops, *Minnesota, *Primary productivity, *Sedges, Forests, Grasslands, Rooted aquatic plants, Biomass, Peat, Carex sp.

Standing crops were measured in sedge meadows along a 135 km transect from forest to prairie in northwestern Minnesota. Eight of the meadows were located in forest sites; all but one were on waterlogged fibrous peat. These sites were dominated by Carex lacustris (4 sites), C. lasiocarpa (2), C. rostrata (1) and C. atherodes (1). Above-ground standing crops ranged from 425 to 738 g dry wt./sq m, with a mean of 606 g/sq m. The five prairie sites occurred on well-drained silty peats, and standing crops ranged from 679 to 1248 g dry weight per sq m, with a mean of 941 g per sq m. Above-ground standing crop in prairie site was 55% greater than in forest sites. (Stihler-Mass)
W79-08546

HAS THE PRIESTLEY-TAYLOR EQUATION ANY RELEVANCE TO FOREST EVAPORATION,
Institute of Hydrology, Wallingford (England).
W. J. Shuttleworth, and I. R. Calder.
Journal of Applied Meteorology, Vol. 18, No. 5, p 639-646, May 1979. 4 fig, 1 tab, 30 ref.

Descriptors: *Evaporation, *Precipitation(Atmospheric), *Forest watersheds, Forestry, Forests, Radiation, Interception, Meteorological data, Soil moisture, Meteorology, Equations, Trees, *England, *Priestley-Taylor equation, *Forest evaporation, Net radiation, Potential evaporation, Meteorological conditions, Scots Pine forest, Forest environment.

Long-term evaporation measurements were expressed in the Priestley-Taylor 'potential evaporation' framework for a spruce forest in Plynlimon, Wales, and a Scots Pine forest in Norfolk, England. The results were used to illustrate the possibility of significant variability in evaporation from forest vegetation in response to precipitation input, and so provided a warning against the indiscriminate use of the Priestley-Taylor formula. A tentative suggestion was made regarding a possible role for potential evaporation in the forest environment. (Roberts-ISWS)
W79-08552

HYDROLOGICAL, METEOROLOGICAL, AND AGRICULTURAL RELATIONS IN NORTHERN IRAQ,
Ministry of Irrigation, Baghdad (Iraq).
For primary bibliographic entry see Field 3F.
W79-08561

A TECHNIQUE FOR THE DIRECT MEASUREMENT OF WATER STORAGE ON A FOREST CANOPY,
University of Strathclyde, Glasgow (Scotland). Dept. of Applied Physics.
For primary bibliographic entry see Field 2B.
W79-08577

VEGETATION RESPONSE TO CONTOUR FURROWING,
Agricultural Research Service, Sidney, MT. Northern Plains Soil and Water Research Center.
J. R. Wight, E. L. Neff, and R. J. Solseth.
Journal of Range Management, Vol. 31, No. 2, p 97-101, March, 1978. 3 tab, 2 fig, 8 ref.

Descriptors: *Contour furrows, *Range management, *Environmental effects, *Vegetation establishment, Furrow systems, Crop response, Runoff, Erosion, Panspot soils, Saline soils, Soil moisture, Vegetation effects, Water yield improvement, Land management, Montana.

Although contour furrowing was one of the first land surface modification treatments applied to rangeland to increase forage production and reduce runoff and erosion on fine-textured erodable soils, more information is needed regarding the long term vegetation responses and site treatment interactions with this technique, accordingly, the purpose of the present paper is to examine the vegetation responses of panspot and saline upland range sites to contour furrowing over an eight year period in arid southwestern Montana. Sixteen 0.8 hectare watersheds, 12 on a panspot range site with average slopes of 1 to 50%, and 4 on a saline upland range site with an average slope of 3%, were established in November 1967, with half of the watersheds at each site being contour-furrowed with an arcadia model B contour furrower. Results indicated that contour furrowing increased average annual herbage production by 165% and plant available soil water by 107% and reduced basal cover 73% on the panspot range sites while it increased available water but had no significant effect on total herbage or basal cover on the saline-upland sites. These results are attributed primarily to the reduced summer runoff and increased over winter recharge. It is concluded that contour furrowing can be be an effective tool for increasing soil water and herbage production on panspot and saline upland range sites. (Tickes-Arizona)
W79-08617

2J. Erosion and Sedimentation

ESTUARINE PROCESSES, VOLUME I AND II.
For primary bibliographic entry see Field 2L.
W79-08543

SUSPENDED LOAD FROM ERROR-FUNCTION MODELS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. C. Willis.
Journal of Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14684, p 801-816, July 1979. 6 fig, 1 tab, 17 ref, 2 append.

Descriptors: *Alluvial channels, *Hydraulics, *Rivers, *Model studies, Streams, Suspended load,

Turbulent flow, Sedimentation, Turbulence, Turbulent boundary layers, Equations, Sands, *Alluvial streams, Turbulent diffusivity, Concentration distribution.

Models for the vertical distributions of flow velocity and sediment concentration based on the assumption of an error-function distribution of turbulent diffusivity were used in calculating the suspended-load discharges for two sets of flume data. The flow and sediment variables required for the calculation procedure were the mean flow velocity, flow depth, shear velocity, and fall velocity and diameter of the sediment particles. For coarse sand (D = 0.54 mm), the effective bed concentration served as a convenient reference concentration for the suspension calculations, but for the fine sand (D = 0.1 mm) for which statistical bed-form data were not available, a measured reference concentration was required to facilitate agreement between measured and calculated discharges of suspended sediment. For the 0.54 mm sand, the effective bed concentration was obtained from the probability density function of the bed surface, which could be approximated by a gamma function. (Lee-ISWS)
W79-08559

THEORY OF MINIMUM RATE OF ENERGY DISSIPATION,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. T. Yang, and C. C. S. Song.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14677, p 769-784, July 1979. 5 fig, 23 ref, I append.

Descriptors: *Fluvial sediments, *Open channel flow, *Power head, Energy dissipation, Hydraulics, Equations, Mathematical studies, Rivers, Alluvial channels, Theorctical analysis, Flow, Sediments, Turbulent flow, Laminar flow, Transition flow, *Fluvial hydraulics, Navier-Stoke's equation, Fluvial processes.

A general theory of minimum rate of energy dissipation for a class of open channel flows with or without the movement of sediment was proposed in this paper. This theory states that the rate of energy dissipation is a minimum under steady equilibrium or gradually varied flow conditions. The theory was derived from the Navier-Stoke's equations of motion for gradually varied, open channel flow without sediment transport. It applies to turbulent and laminar flows as long as the inertia forces due to the time-averaged velocity distribution are small compared with the forces due to gravity and shear. The theory in different degrees of generality can be used to explain the fluvial processes from the movement of sediment to the change of velocity, slope, roughness, channel geometry, pattern, and profile of a river under an equilibrium condition or during the process of self-adjustment to reach an equilibrium condition. (Lee-ISWS)
W79-08560

MINIMUM STREAM POWER AND RIVER CHANNEL PATTERNS,
San Diego State Univ., CA. Dept. of Civil Engineering.
H. H. Chang.
Journal of Hydrology, Vol. 41, No. 3/4, p 303-327, May 1979. 14 fig, 37 ref.

Descriptors: *Channel morphology, *Rivers, *Streams, Sediments, Transport, Flow resistance, Valleys, Equations, Alluvial channels, Meanders, Hydraulics, Slopes, Sediment discharge, Discharge(Water), Bedload, Velocity, *Stream power, Channel patterns, Valley slope, Braided channels.

Channel patterns of sand-bed rivers were analyzed using the concept of minimum stream power together with formulas for flow resistance and sediment transport. A diagram was constructed, on the plane of water discharge vs. valley slope, dividing regime rivers into straight, meandering, and braided patterns in plan configuration. The analytical diagram was supported by river data and previous observations. For the given water discharge Q and sediment load Q sub s, the stable channel geometry and slope were obtained from the stream power analysis, wherein a stable configuration is assumed to correspond to a minimum stream power per unit channel length. For small values of Q and Q sub s, the analysis showed that a unique minimum exists, indicating a unique stable channel configuration and slope. With this unique stable channel slope equal to the valley slope, the channel pattern is straight. Above a certain threshold valley slope, the stream power actually has two minimums, indicating two possible stable channel configurations and slopes. Whenever multiple channel slopes exist on a uniform valley slope, the river must be sinuous. The reason for meandering development was attributed to minimum stream power per unit channel length for the river system, because with its multiple configurations and slopes, a meandering river may minimize its stream power expenditure as well as its sediment load for the river system subject to physical constraints. Analytical relations also predicted that highly sinuous rivers which are small in width/depth ratio occur on flatter valley slopes and that they become more braided and less sinuous as the valley slope increases. (Lee-ISWS)
W79-08567

ATMOSPHERIC ENHANCEMENT OF METAL DEPOSITION IN ADIRONDACK LAKE SEDIMENTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W79-08581

INSTABILITY OF ALLUVIAL VALLEY FLOORS: A METHOD FOR ITS ASSESSMENT,
Geological Survey of Israel, Jerusalem; and Colorado State Univ., Fort Collins.
Z. B. Begin, and S. A. Schumm.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 347-350, March-April 1979. 6 fig, 9 ref. OWRT B-150-COLO(1), 14-34-0001-7143.

Descriptors: *Alluvium, *Valleys, *Stability, *Gullies, Erosion, Gully erosion, Washouts, Sediments, On-site investigations, Data processing, Mathematical models, Stress, Shear stress, Drainage, Geomorphology, *Alluvial valley floors.

Using previously collected data on the morphology of semiarid valleys, a technique was developed for discriminating between stable and unstable valley floors. Relations between drainage area, discharge, and flow depth were used to develop a shearstress indicator that can be used to identify those reaches of a valley floor that are most likely to fail by gullying. (Sims-ISWS)
W79-08583

DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENT CORES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2A.
W79-08625

BED PARTICLE REYNOLDS MODELLING FOR FLUID DRAG,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
N. L. Coleman.
Journal of Hydraulic Research, Vol. 17, No. 2, p 91-105, 1979. 8 fig, 14 ref.

Descriptors: *Bed load, *Model studies, *Sediment transport, Reynolds number, Drag, Streambeds, Shear drag, Hydraulics, Erosion, Streamflow, Riprap, Flow, Velocity, *Fluid drag, Bounded shear flow, Shear velocity.

A scaled-up Reynolds model of a sediment particle on a streambed has been used to study the drag force exerted by streamflow. The results have been presented as a data trend relating particle drag coefficient to particle Reynolds number. The modified drag coefficient and Reynolds number used take into account the presence of bounded shear flow by using a characteristic velocity determined from the relation between the approach flow velocity and the shear velocity on the streambed. (Lee-ISWS)
W79-08630

SUSPENDED- AND BEDLOAD-SEDIMENT TRANSPORT IN THE SNAKE AND CLEARWATER RIVERS IN THE VICINITY OF LEWISTON, IDAHO, AUGUST 1976 THROUGH JULY 1978,
Geological Survey, Boise, ID. Water Resources Div.
M. L. Jones, and H. R. Seitz.
Geological Survey open-file report 79-417, 1979. 87 p, 22 fig, 16 tab, 10 ref.

Descriptors: *Sediment transport, *Baseline studies, *Pre-impoundment, *Post-impoundment, *Idaho, Hydrologic data, Suspended load, Bed load, Streamflow, Channel morphology, Data collections, Sedimentation, *Snake River(IA), *Clearwater River(IA).

Water in the Snake and Clearwater Rivers was impounded beginning June 1975 when Lower Granite Dam became operational. Construction and operation of this facility necessitated collection of hydraulic- and channel-geometry data and description of sediment-transport characteristics in these rivers. This report summarizes information collected during August 1976 through July 1978 and is the fifth in a series of similar reports that began in 1972. Relatively minor amounts of sediment were transported during the 1977 drought period. Therefore, regular scheduled sampling of the bedload was impractical. Data for the 1978 runoff period indicate lower-than-average sediment transport in both rivers. Combined 1978 totals show that about 1,200,000 tons of sediment passed the Lewiston area. Hydrologic data collected from March 1972 through July 1978 are shown by various graphical presentations. (Woodard-USGS)
W79-08700

2K. Chemical Processes

FLUX OF ORGANIC MATTER THROUGH A SALT MARSH,
Georgia Univ. Athens.
For primary bibliographic entry see Field 2I.
W79-08544

SIMULTANEOUS TRANSPORT OF WATER AND REACTING SOLUTES THROUGH MULTILAYERED SOILS UNDER TRANSIENT UNSATURATED FLOW CONDITIONS,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
For primary bibliographic entry see Field 2G.
W79-08570

HYDROLOGICAL APPLICATIONS OF NOBLE GASES AND TEMPERATURE MEASUREMENTS IN UNDERGROUND WATER SYSTEMS: EXAMPLES FROM ISRAEL,
Weizmann Inst. of Science, Rehovot (Israel).
For primary bibliographic entry see Field 2G.
W79-08571

EVAPORATION OF WATER FROM SAND: THE EFFECT OF EVAPORATION ON THE PRECIPITATION OF SALTS DISSOLVED IN WATER STORED IN SAND,
National Inst. for Water Research, Windhoek (South West Africa).
For primary bibliographic entry see Field 2D.
W79-08574

ION EXCHANGE REACTIONS IMPORTANT IN GROUNDWATER QUALITY MODELS,
Geological Survey, Denver, CO. Water Resources Div

For primary bibliographic entry see Field 6A.
W79-08643

2L. Estuaries

ST. LUCIA ESTUARY: EVALUATION OF NATURAL RESOURCES,
Town and Regional Planning Commission, Pietermaritzburg (South Africa).
A. M. Little, and A. J. Phelan.
South Africa Journal of Science, Vol. 74, p 8-11, January 1978. 5 fig, 1 ref.

Descriptors: *St Lucia Estuary, *Land use, *Estuarine environment, Estuaries, Aquatic environment, South Africa, Natural resources, Recreation facilities, Conservation, Resources, Water resources development, Mapping, Evaluation, Parks.

A procedure for evaluating the natural resources of the recreation resort, the St. Lucia Estuary, in order to indicate its optimum land use management is described. The area under study covered 3,700 hectares characterized by high coastal dunes, a unique dune forest, and excellent sport fishing. The flood plains of the Umsinduzi and Umfolozi rivers add diversity to the ecosystem including areas of papyrus and reed swamp, mangrove, exotic and coast forest, vlei and bush grassland, and pans. A broad evaluation to determine those areas most suitable for development was conducted so as to select three distinctive zones: areas sensitive to man's instrustion which should be set aside in a conservation zone, areas suitable for limited recreation, and areas suitable for more intensive recreation and/or urban occupation. Five evaluation criteria were considered essential for zone determination; an analysis of these identified 16 vegetation communities. These 16 were grouped into 4 classes according to conservation importance. Factor maps were superimposed and studied for correlations, anomalies, and distinctive patterns. By assigning a numerical score to each map grid square, zones which had the same scores could be grouped. There was flexibility in the planning and use of areas; boundaries between zones are seen as points on a continuum rather than as clearly defined lines. (Schaefer-IPA)
W79-08510

FISHES OF THE KOSI SYSTEM,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology.
S. J. Blaber.
Lammergeyer, Vol. 24, p 28-41, March 1978. 2 fig, 7 tab, 14 ref, 1 append.

Descriptors: *Fish types, *Estuarine environment, *Lakes, Lake Nhlange, Lake Sifungwe, Lake Mpungwini, Lake Amanzimnyama, South Africa, Fish populations, Fish, Aquatic animals, Freshwater fish, Saline water fish, Estuaries, Saline lakes.

The very diverse fish fauna of each part of the Kosi system was studied to establish the important characteristics and seasonal variations of the fauna. The Kosi system consists of four district but connected basins, each with different physical characteristics and seasonal variations of the fauna. The system drains to the sea through a usually permanently open estuary. Five samplings of fish were taken per annum for 1975, 1976, and 1977 using gill, seine, and fry nets and an open water trawl. Physical characteristics of the system important to the fish populations include tides, current speeds, salinity, water temperatures, substrate, and plant detritus. The three most important are: (1) the virtual separation of Sifungwe and Mpungwini by low water levels during neap tides and droughts, (2) the current speeds in the reed channel between Sifungwe and Nhlange which may exceed those at the estuary mouth during rainy season and (3) a combination of low temperatures and low salinities of Lake Nhlange. A total of 124 species of marine fishes (not including freshwater species) were recorded. About 70% were restricted to the estuary and the reef within the estuary; the remainder were estuarine resident species and euryhaline marine species which penetrate the system to a varying extent. Seasonal changes in distribution and density are described for some of the species, and related where necessary to physical characteristics of the different regions. (Schaefer-IPA)
W79-08518

ESTUARINE PROCESSES, VOLUME I AND II.
M. Wiley, editor, Academic Press, New York, N.Y. 1976. 969 p.

Descriptors: *Estuaries, *Wetlands, *Physical properties, *Biological properties, *Ecology, Circulation, Marshes, Tidal marshes, Salt marshes, Remote sensing, Fish, Nutrients, Wildlife, Invertebrates, Rooted aquatic plants, Sediments, Mathematical models.

Volume I--subtitled, Uses, Stresses and Adaptation to the Estuary--contains 37 papers in the following seven categories: Rehabilitation of estuaries, Nutrient cycling in estuaries, Population dynamics, Wetland uses, Behavior as a measure of sublethal stress, Physiological and biochemical adaptations and Cycling of pollutants. Volume II--subtitled, Circulation, Sediments, and Transfer of Material in the Estuary--contains 27 papers in the following six categories: Effects of physical alterations, Introduction to sedimentary processes I; Suspended sediment transport and circulation, Introduction to sedimentary processes II: Suspended sediment transport and circulation, Interactions between tidal wetlands and coastal waters, Circulation models and Tools and methods. Each volume contains an index. (Stihler-Mass)
W79-08543

WIND-DRIVEN CIRCULATION IN THE CHESAPEAKE BAY, WINTER 1975,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
D.-P. Wang.
Journal of Physical Oceanography, Vol. 9, No. 3, p 564-572, May 1979. 6 fig, 9 ref. OCE 74-08463, OCE 77-20254.

Descriptors: *Circulation, *Estuaries, *Currents(Water), *Frequency, *Chesapeake Bay, *Stratified flow, Wind velocity, Velocity, Salinity, Mathematical models, Saline water intrusion, Tidal waters, Model studies, Wind stress, Volume flux, Salinity distributions.

Nontidal circulation in Chesapeake Bay was examined from one-month current records at 50 and 200 km from the entrance. The monthly mean flow was basically a two-layered circulation; in addition, there were large wind-driven velocity fluctuations at several-day time scales. Corresponding to velocity changes, the salinity distribution had large variations, comparable to its seasonal change. Bay water responded to longitudinal (local) wind and coastal (nonlocal) Ekamn flux. The response was barotropic in the lower Bay, and baroclinic (frictional) in the upper bay. The difference in response characteristic appears to be due to the counter-effects of the near-surface windstress shear and the depth-independent surface slope. A frictional model accounted for most of the observed features. Results of this study provided further evidence of large, atmospherically induced exchange between the estuary and coastal ocean. The importance of wind on upstream salt intrusions was also clearly demonstrated. (Adams-ISWS)
W79-08555

ENLARGEMENT OF MARCUS HOOK ANCHORAGE, DELAWARE RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. F. Athow, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 541, Price codes: A06 in paper copy, A01 in microfiche. Miscellaneous Paper H-76-17, September 1976. 4 fig, 8 tab, 13 photo, 53 plate, 6 ref.

Descriptors: *Delaware, *Density currents, *Model studies, *Tides, *Currents(Water), *Bays, *Delaware River, Salinity, Dispersion, Shoals, Navigation, Navigable waters, Dredging, *Tidal currents, Tidal heights.

An existing comprehensive physical model that correctly reproduced tides, tidal currents, and density currents throughout the entire Delaware Bay and River was used to determine the effects of enlargement of the Marcus Hook Anchorage. The study included tests in the model of the plan configuration to define its effects on tidal heights, current velocities, salinities, surface current patterns, dye dispersion, and postdredging shoal developments. Based on the results of the model tests, the following conclusions were reached: (1) the plan would have no effect on tidal heights or tidal phasing; (2) the effects of the plan on current velocities and patterns would be minimal; (3) the plan would not significantly change the salinity regime when low-flow conditions allow salinity to intrude into the study area; (4) the plan caused a trend for dye concentrations to increase within and in the immediate vicinity of the Marcus Hook Anchorage for dye released between the main navigation channel and the proposed enlargement; and (5) the effects of the plan on shoaling rates would be to increase the efficiency of the Marcus Hook Anchorage as a sediment trap, due to the enlarged cross-sectional area. It was concluded that although no significant change in the shoaling rate in the navigation channel would be observed, a redistribution of the shoaling in the study reach can be expected. (Bhowmilk-ISWS)
W79-08610

DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENT CORES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2A.
W79-08625

POTENTIAL POLLUTION OF A MARINE ENVIRONMENT BY LEAD ALKYLS: THE CAVTAT INCIDENT,
Istituto di Ricerca sulle Acque, Bari (Italy).
For primary bibliographic entry see Field 5C.
W79-08627

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION TODAY,
National Inst. for Water Research, Pretoria (South Africa).
G. R. Botha, and G. L. Dalton.
Scientiae, Vol. 18, No. 4, p 2-11, December 1977. 13 fig.

Descriptors: *Desalination, *Desalination processes, Vapor compression distillation, Sea water, Desalination apparatus, Desalination wastes, South Africa, Water treatment, Membranes, Evaporators, Distillation, Electrodialysis, Freezing, Reverse osmsosis, Ion exchange, Solar distillation, Costs.

Desalination technology is examined for the world in general and for South Africa in particular. Due to the high unit cost of the product water, desalination is only likely to come into its own in areas where alternative supplies are not available or are extremely costly. The four basic types of distillation plants in use are examined: multistage, multiple effect, vapor compression, and solar evaporators. Four other desalination processes are discussed. The freezing process has operated only on a small experimental basis. This process is considered unduly complex and its possible cost advantage are not felt to justify the added complexity. Electrodialysis is a highly efficient process but has been shown to be economical only with brackish waters of relatively low salinity. Reverse osmosis systems are comparatively simple and have shown good performance results; significant improvements are expected and these will lower the cost. Ion exchange is a simple, reliable, low-cost process sometimes used in conjunction with other of the processes. Solar evaporation, distillation, freezing, and electrodialysis are considered as possible

means of brine disposal; the first appears to be the only option for South Africa. Much of the research effort in South Africa is being expended on reverse osmosis; the role of desalination in sewage reclamation is also being investigated. (Schaefer-IPA)
W79-08511

3C. Use Of Water Of Impaired Quality

GEOTHERMAL POWER PRODUCTION WITH IRRIGATION WASTE WATER,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
Ground Water, Vol. 17, No. 4, p 375-384, July-August 1979. 6 fig, 3 tab, 32 ref.

Descriptors: *Irrigation water, *Thermal power, *Waste water, Water reuse, Water resources, Impaired water use, Injection wells, Heated water, Steam, Thermal water, Thermal powerplants, Geothermal studies, Saline water, Salinity, Energy, *Irrigation waste water.

Both irrigated agriculture and areas with dry, hot-rock formations at relatively small depth are ubiquitous in the western United States. The former produces saline percolation water, while the latter needs water to transfer the heat to the surface to enable exploitation of the geothermal energy. Thus, it seems logical to investigate the possibility of converting irrigation return flow, which often presents an environmental liability, into a useful asset by pumping it into artificially stimulated hot-rock formations. When brought up as hot fluid, the water can then be used for generating power, producing freshwater, and/or space heating. The paper summarized quantity and quality of irrigation return flow, various types of geothermal systems, and quantities of power and freshwater that can be derived from steam or hot water. (Sims-ISWS)
W79-08619

3D. Conservation In Domestic and Municipal Use

WATER ECONOMY -- WHERE TO SOUTH AFRICA,
Council for Scientific and Industrial Research, Pretoria (South Africa). Building Services Div.
H. R. Boyd.
Municipal Engineer, Vol. 9, No. 1, p 55-59, January/February 1978.

Descriptors: *Water conservation, *Water utilization, *Domestic water, Municipal water, Water consumption(Except consumptive use), Waste disposal, South Africa, Lawns, Recirculated wastes, Water policy, Domestic wastes, Wastes, Sewage, Urine, Toilets.

The current thinking on water economy measures in urban areas is reviewed. Those measures appropriate for immediate application and measures which are more relevant to future conditions are suggested. Possible reductions in water demand, if such measures were applied, are assessed. The present need in South Africa is for cheap, simple economy measures that will cause little disruption to the traditional activities of water users. Sophisticated methods can be considered, developed, and progressively introduced in time, after the simpler means. Alternatives to the ordinary wash-down water-closet (W.C.) with flushing cistern include dual flush cisterns, reduced flush volume cisterns, use of waste water from sinks, baths, and hand wash basins for flushing, and chemical incinerating, composting, biological, oil flushed, vacuum, and recirculating toilets. Modifications to urinals include reductions of flushing water, waterless urinals, and shutting off the water in periods of non-use. Spray mixer taps could cause significant water economies in W.C. compartments and cloakrooms. Smaller baths and atomizer nozzles are suggested for baths and showers. Washing machines, dishwashers, and sink waste disposal units are the principal water using domestic appliances; redesigning machines and using machines only for full loads could conserve water in washers. Car washing and garden watering are two more areas where water can be conserved. (Schaefer-IPA)
W79-08584

3F. Conservation In Agriculture

WATER FOR THE HIGHVELD,
Rhodesia Dept. of Conservation and Extension, Salisbury.
G. J. Wilson.
Rhodesia Science News, Vol. 12, No. 1, p 14-18, January 1978. 2 fig, 1 tab.

Descriptors: *Irrigation practices, *Irrigation effects, Rhodesia, Irrigated land, Irrigation programs, Arable land, Soil-water-plant relationships, Water management(Applied), Water policy, Agriculture, Crops, Water resources, Productivity.

The present impact of irrigation on the Highveld, the use of available water resources, and the future pattern of irrigation development are discussed. Competition for water among agriculture, industry, and domestic uses is already evident in Rhodesia. The total irrigation area on the Highveld is estimated at 300,000 hectares. The catchment areas for runoff required to supply the irrigation requirements of various crops differ from area to area. A balanced apportionment of runoff between farm dam storage in the upper catchment and major storage works downstream is needed. The increase in crop yield and crop value due to irrigation must cover the investment for irrigation equipment, maintenance, and power. The profitability of the scheme will depend to a large extent on whether the equipment can be used on winter and summer crops. The appropriate system of planting and irrigation depends on the crops response to water stress. The economic considerations of irrigation make it very unlikely that the maize growing areas will extend significantly into drier parts. Irrigation is expected to cause expansion in the production of wheat, tobacco, ground-nuts, coffee, cotton, and other vegetable and fruit crops. (Schaefer-IPA)
W79-08514

HYDROLOGICAL, METEOROLOGICAL, AND AGRICULTURAL RELATIONS IN NORTHERN IRAQ,
Ministry of Irrigation, Baghdad (Iraq).
F. Y. El Yussif.
Water Resources Bulletin, Vol. 15, No. 3, p 753-765, June 1979. 12 fig, 6 tab, 6 ref.

Descriptors: *Crop production, *Precipitation(Atmospheric), *Irrigation, Wheat, Barley, Runoff, Rainfall, Crops, Rainfall-runoff relationships, Agriculture, Hydrology, Meteorological data, Meteorology, *Iraq, *Northern Iraq.

The northern regions of Iraq, an area comprised of mountains and undulating plains, has for centuries been the main granary for the country. Its agricultural production is largely dependent upon natural rainfall, which ranges from about 300 to 1,000 mm/yr. Grain yields can be greatly improved by use of improved varieties and management practices. Equations were developed to show relationship between various hydrologic and meteorologic parameters with yields of wheat and barley. The amount of supplementary water needed to maximize grain yields was also shown. (Sims-ISWS)
W79-08561

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

CONTROL OF WATER HYACINTHS IN SOUTH AFRICA.
Munisipale Ingenieur, Vol. 8, No. 6, p 39-43, November/December 1977.

Descriptors: *Water hyacinth, *Aquatic weed control, Aquatic plants, Aquatic weeds, Herbicides, Biocontrol, Diquat, Paraquat, Clarosan, Mechanical control, Insects, Snails, Pathogenic fungi, Fish, Mammals, Chemcontrol, South Africa.

The present state of controlling water hyacinths (Eichhornia crassipes) in South Africa is examined. Methods of control are biological, chemical, and mechanical; only a few of the possibilities can be applied under local conditions. Of all the biological control agents only five groups or organisms have shown some promise: insects, snails, phytopathogens, fish, and mammals. Biological control is the ideal solution to the problem, but there are difficulties involved with this method. They include: (1) all natural enemies of the hyacinth are tropical species and need to be laboratory-reared in South Africa, (2) fish and mammals are not suited to South African conditions, (3) phytopathogens must be monitored to prevent their attacking food crops, and (4) the biological process is very lengthy. Three herbicides have been passed for use: Paraquat, Diquat, and Clarosan. They are cheap, rapid, effective and easy to use; their disadvantages make them a practical means as an emergency measure. Mechanical control is possible but has the drawback that the biomass of the plant must be used. The plant matter can be used as animal feed and compost, and in the production of paper, gas, alcohol, and protein, but there are other and more economical sources for all these. (Schaefer-IPA)
W79-08515

ECOLOGICAL INVESTIGATION OF DAMS IN THE UMFOLOZI GAME RESERVE,
Natal Parks Board, Pietermaritzburg (South Africa). Hluhluwe Game Reserve.
For primary bibliographic entry see Field 7A.
W79-08522

FLOODPLAIN PAINS,
Texas A and M Univ., College Station.
J. McNeely
Tierra Grande, No. 7, p 12-15, Second Quarter 1979. 3 fig.

Descriptors: *Flood control, *Flood plains, *Water management(Applied), Flood plain insurance, Runoff, Flood forecasting, Floods, Flood recurrence interval, Insurance, Economics, Flood plain zoning, Flood damage, Property values, Flood Disaster Protection Act of 1973, National Flood Insurance Act.

Flooding and floodplain management programs are discussed. Several factors, usually interrelated, affect flooding problems. The type of problems are primarily determined by the general climatic zone of the watershed concerned. Surface and subsurface geologic materials, steepness of slope, width of a floodplain, stream densities, and stream flow conditions all affect runoff. Land use and treatment can affect runoff and resultant flooding adversely or favorably. Parks, greenbelt areas, and other such land uses aid floodwater removal, and decrease runoff and damages. The conversion of land from open space or agricultural use to urban use increases the impervious area; the costs and damages associated with increased flood hazard may cause property values to decrease. Structural flood control methods have been popular with planners in the Texas area. Storm water runoff is regulated by modifying the topography in a way that avoids changing the runoff pattern. The National Flood Insurance Actand the Flood Disaster Protection Act of 1973 aid in providing disaster relief. Housing and Urban Development (HUD) requirements for floodplain controls are aimed at removing unsafe structures from the floodplain and preventing new ones from being built. State and Federal Government agencies generally support HUD-originated control; local governments generally desire local control. (Schaefer-IPA)
W79-08597

ENLARGEMENT OF MARCUS HOOK ANCHORAGE, DELAWARE RIVER,

Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 2L.
W79-08610

GROUND-WATER INDUCED CHANGES IN LAKE CHEMISTRY,
University of South Florida, Tampa. Dept. of Chemistry.
P. M. Dooris, and D. F. Martin.
Groundwater, Vol. 17, No. 4, p 324-327, July-August 1979. 1 fig, 1 tab, 13 ref.

Descriptors: *Water chemistry, *Lakes, *Groundwater, *Florida, Pumping, Water quality, Hydrogen ion concentration, Hardness(Water), Carbon, Rainfall, Dry seasons, Aquatic plants, *Lake Starvation(FL), *Lake Hobbs(FL), Augmentation, Floridan aquifer.

Significant changes in the relative proportions of 8 major ions in lake waters can be ascribed to large-scale augmentation of lakes with water pumped from the Floridan aquifer. The pre-augmentation diagram for Lake Starvation matches the ionic diagram for Lake Hobbs, while the post-augmentation diagram for Starvation is virtually identical to the ionic diagram for groundwater from the Floridan aquifer. Finally, the ionic diagrams for Lake Hobbs (which was not subjected to groundwater augmentation) showed that the relative proportions of the 8 ionic constituents have not changed. (Visocky-ISWS)
W79-08624

MATHEMATICAL MODEL FOR SIMULATING DISCHARGES ON THE SABINE RIVER BETWEEN TATUM AND RULIFF, TEXAS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
B. L. Neely, Jr.
Geological Survey open-file report 79-566, April 1979. 31 p, 15 fig, 9 tab, 4 ref.

Descriptors: *Mathematical models, *Simulation analysis, *Streamflow, *Flood routing, *Reservoir releases, Natural flow, Rainfall-runoff relationships, Precipitation excess, Hydrographs, Reach(Streams), Texas, Louisiana, Dams, *Toledo Bend Reservoir, *Sabine River, *Tatum(TX), *Ruliff(TX).

A mathematical model for simulating discharges on the Sabine River between Tatum and Ruliff, TX., was developed to evaluate the effects of release schedules on discharges from the Toledo Bend Reservoir compared to discharges under natural conditions. Using the discharge at Tatum, TX., the rainfall over the basin, and the discharge release schedule for the reservoir, discharge hydrographs for the natural and reservoir-controlled conditions can be computed. (Woodard-USGS)
W79-08695

DEVELOPMENT OF A SORBENT DISTRIBUTION AND RECOVERY SYSTEM,
Seaward International, Inc., Falls Church, VA.
S. H. Shaw, R. P. Bishop, and R. J. Powers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 347, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/7-78-217, 1978. 76 p, 25 fig, 4 tab, 5 ref, 1 append.

Descriptors: *Oily water, *Oil spills, *Sorption, *Polymers, *Plastics, Separation techniques, Oil wastes, Reclamation, Porous media, Water treatment, Water pollution.

A foam sorbent prototype system was developed and tested for the recovery of oil spilled on surface waters. The reusable sorbent foam is a high tensile, open cell polyurethane with a density of 16-32 kg/cu m and a pore size of 1-3 pores/mm with an absorbing capacity of up to 30 times its weight; up to 90% of the oil was removable by squeezing the foam. The foam is in the form of small cubes and the entire mobile system may be transported in two pickup trucks. A pneumatic broadcaster transports and distributes the foam sorbent over the affected water and an inclined open wire mesh belt conveyor recovers the saturated sorbent from the water. The sorbent is squeezed in a converging belt press or regenerator to recover oil and water and is returned to the water following regeneration. The system managed sweep speeds up to 5 knots in calm and turbulent water, achieving oil recovery rates of 10.5 cu m/hr. The oil content of the recovered liquid in the sorbent ranged from 38-79%. (Lisk-FRC)
W79-08743

COOPER RIVER ENVIRONMENTAL STUDY,
South Carolina Water Resources Commission, Columbia.
Report No. 117, F. P. Nelson, Editor, April 1974. 164 p, 27 fig, 1 append.

Descriptors: *Cooper River(SC), *Charleston Harbor(SC), *Diversion, *Saline water intrusion, *Sediment transport, *Low flow, *Silting, *Environmental effects, Water levels, Water pollution sources, Water management(Applied), Dredging, Channel improvement, Biochemical oxygen demand, Saline water-freshwater interfaces, Atlantic Ocean, Santee-Cooper River Diversion Project(SC), Water supply, River basin development, Watersheds(Basins), Bottom sediments, Sedimentation, Municipal wastes, Industrial wastes, Estuaries, Baseline studies.

A comprehensive baseline study of biochemical and physical parameters of the Cooper River in South Carolina shows that projected rediversionary streamflow reduction from 15,600 avg wkly cfs to 3000 cfs would reduce siltation in Charleston Harbor (caused by diversion since 1942 of large volumes of Santee River water into the Cooper River system) and would alleviate need for continued extensive harbor dredging. However, the proposed rediversion could conceivably generate a number of negative water quality and quantity effects: (1) Salt water encroachment under reduced flow conditions could endanger the fresh water supply for some industrial and urban users. (2) Severe oxygen depletion could result from rediversion, and might necessitate imposition of waste load limits into the river system. (3) Residual waste in the river, caused by industrial and municipal effluents, might be transported upstream by Atlantic Ocean tides during periods of minimum river flow. On the other hand, a mixed saltwater-freshwater estuarial condition would provide for more rapid seaward transport of bottom materials (as existed before 1942); removal of such deposits would reduce oxygen uptake potentials in the lower Cooper River and elsewhere in the harbor and alleviate concern that septicity could occur during periods of low flow and elevated temperature. (Harris-Wisconsin)
W79-08830

4B. Groundwater Management

ARTIFICIAL RECHARGE IN SOUTH PLATTE RIVER BASIN,
Bureau of Reclamation, Denver, CO.
L. K. Weston, and R. E. Swain.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR2, Proceedings paper 14606, p 117-127, June 1979. 4 fig, 13 ref, 2 append.

Descriptors: *Artificial recharge, *Groundwater recharge, *Groundwater resources, *Colorado, *Aquifer management, *Irrigation water, Equations, Aquifers, Water rights, Surveys, Water quality, *South Platte River, Water resources management, Water allocation.

A reconnaissance study of the potential for artificially recharging the alluvial aquifer along 110 miles of the South Platte River from Fort Morgan to Julesburg, Colorado, was made based on published hydrologic and geologic information. Analyses were made to determine the availability of water for recharge; anticipated infiltration rates; potential storage capacity of the groundwater reservoir; the degree of groundwater mounding beneath potential recharge sites; the magnitude of annual drain-out loss to the river; possible water quality problems; and the potential effects on the South Platte River flows. Artificially recharging the alluvial aquifer appears technically feasible. Water-logging conditions are likely to develop in areas that lie within 1 mile or 2 miles of the river. Due to the high dissolved solids concentration of the recharge water, the quality of the groundwater in some areas may deteriorate and preclude its use for domestic and municipal water supplies. (Adams-ISWS)
W79-08553

ADVANCES IN GROUNDWATER HYDROLOGY.
For primary bibliographic entry see Field 2F.
W79-08631

STATUS OF QUANTITATIVE GROUNDWATER HYDROLOGY,
Geological Survey, Reston, VA. Water Resources Div.
J. D. Bredehoeft.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 8-14, September 1976. 1 fig, 7 ref.

Descriptors: *Reviews, *Hydrogeology, *Groundwater movement, Theoretical analysis, Evaluation, Model studies, Groundwater resources, Groundwater availability, Aquifer management.

Several numerical methods have been developed for solving problems of groundwater flow. These models are identified according to the problems they address as follows: (1) flow; (2) transport, including the transport of chemical constituents and energy; (3) coupled groundwater and surface water; (4) coupled groundwater and economics; and (5) more global water-resources model, which include groundwater, and are State, regional, or national in scope. Management decisions are classified as (1) engineering, in which satisfying demands at a minimum cost is included, together with feasibility - will the aquifer provide the quantity of water needed for a desired period; (2) optimizations, in which the attempt is made to maximize benefits, usually economic benefits; and (3) institutional questions - those that are commonly directed toward the legal institutions. One can picture these decisions as being increasingly oriented toward policy questions. Given these classifications of models and management decisions, the use of the models in addressing problems of water-resource management is examined. (See also W79-08631) (Woodard-USGS)
W79-08633

WATER RESOURCES OF THE SANTA YNEZ INDIAN RESERVATION, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. A. Singer.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO. 80225. Paper copy $4.00, microfiche $3.50. Geological Survey open-file report 79-413, March 1979. 27 p, 9 fig, 3 tab, 9 ref.

Descriptors: *Groundwater resources, *Pumping, *Drawdown, *Water quality, *Indian reservations, California, Surface-groundwater relationships, Water wells, Water pollution sources, *Santa Ynez Indian Reservation(CA), Paso Robles Formation, Zanja de Cota Creek, Careaga Sand.

The Santa Ynez Indian Reservation is situated above a bedrock ridge that forms the southern boundary of the Santa Ynez upland ground-water basin. A pumping depression exists upgradient from the reservation, and water levels have declined an average of 1.0 to 1.5 feet per year since the 1940's. This decline in the water level has led to the cessation of perennial flow in Zanja de Cota Creek that traverses the reservation. In the past this creek was fed by the natural discharge of water from the ground-water basin. Water-bearing rock beneath the reservation is limited in thickness

and may become unusable as a water supply source in the near future if water levels continue to decline. The chemical quality of water beneath the reservation is generally acceptable for both irrigation and domestic use; however, large-scale pumping could induce the flow of contaminated water from an area just upgradient. Declines in groundwater levels and the existence of fecal contamination upgradient from the reservation make the successful development of a ground-water supply for the reservation doubtful. (Woodard-USGS)
W79-08698

WATER-LEVEL PREDICTIONS FOR INDIAN WELLS VALLEY GROUND-WATER BASIN, CALIFORNIA, 1978,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-08699

4C. Effects On Water Of Man's Non-Water Activities

WATER CHEMISTRY OF THE REDWOOD CREEK AND MILL CREEK BASINS, REDWOOD NATIONAL PARK, HUMBOLDT AND DEL NORTE COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. L. Bradford, and R. T. Iwatsubo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 253, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-115, December 1978. 112 p, 18 fig, 20 tab, 45 ref.

Descriptors: *Water quality, *Lumbering, *Environmental effects, *Streams, *Water pollution, National parks, Water types, Water chemistry, Nitrogen, Regolith, Soil water, Weathering, California, *Redwood National Park.

A two-year study made in Redwood National Park, Calif., (September 1973-September 1975) determined existing chemical water-quality conditions and identified possible effects of logging on water quality in streams. Water quality was generally good, with dissolved-solids concentrations ranging from 25 to 139 milligrams per liter in the Redwood Creek basin and 21 to 49 milligrams per liter in the Mill Creek basin. Water type and pH tended to shift seasonally. Exposure of soils to the elements in areas logged or having naturally sparse vegetation accelerated chemical weathering and increased dissolved-solids concentrations. Nitrogen and phosphorus concentrations were generally too low to support nuisance algae, but were higher in logged areas. Higher nitrogen concentrations in areas well exposed to sunlight could support modest algae populations. Trace-metal concentrations were low, typical of clean streams. (Woodard-USGS)
W79-08691

4D. Watershed Protection

NONPOINT SOURCE CONTROL GUIDANCE, HYDROLOGIC MODIFICATIONS,
Environmental Protection Agency, Washington, DC. Water Planning Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 709, Price codes: A06 in paper copy, A01 in microfiche. Technical Guidance Memorandum TECH-29, February 1977. 105 p, 3 fig, 12 ref, 3 append

Descriptors: *Water pollution, *Water pollution sources, *Water pollution control, Sediments, Sediment control, Nutrients, Thermal pollution, Chemicals, Channel improvement, Dredging, Floodways, Drainage, Ditches, Runoff, Storm water, Water quality, *Hydrologic modifications, *Best management practices.

Organizations designated to develop comprehensive land and water use plans impacting on water quality management have a responsibility to establish regulations for control of nonpoint pollution sources. The EPA policy requiring establishment of such regulations is contained in the 'Draft Guidelines for State and Areawide Water Quality Management Program Development', February 1976. EPA is currently developing nonpoint source pollution regulatory guidance to provide additional assistance to State and areawide 208 planning agencies in their nonpoint source control programs. This guidance document presents Best Management Practices (BMP) related to hydrologic modifications that the comprehensive plan may incorporate and be implemented through such regulations. The hydrologic modifications nonpoint source pollution control guidance document is provided to assist State and areawide 208 planning agencies in carrying out their water quality management and implementation policies. Emphasis has been focused on the need to prevent those circumstances and situations involving comprehensive land and water management plan development which will produce nonpoint source pollution as a result of hydrologic modifications through application of Best Management Practices. (Sims-ISWS)
W79-08609

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

WATER QUALITY IN MOUNTAIN RECREATIONAL AREAS,
California Univ., Los Angeles, Office of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W79-08580

ATMOSPHERIC ENHANCEMENT OF METAL DEPOSITION IN ADIRONDACK LAKE SEDIMENTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. N. Galloway, and G. E. Likens.
Limnology and Oceanography, Vol. 24, No. 3, p 427-433, May 1979. 4 fig, 4 tab, 14 ref. OWRT A-067-NY(2).

Descriptors: *Lake sediments, *Metals, *New York, *New Hampshire, *Atmosphere, *Fallout, *Northeast U.S., Chemicals, Chemical analysis, Chemistry, Sediments, Cores, Heavy metals, Trace elements, Lakes, On-site data collections, Analytical techniques, Pollutants, Path of pollutants, Water pollution, Water pollution sources, Sedimentation, Limnology, *Adirondack State Park(NY), *Mt. Washington(NH), *Woodhull Lake(NY), *Honnedaga Lake(NY), *Lake of the Clouds(NH).

Sediment cores were collected from Woodhull Lake (Adirondack State Park, New York) in July 1975. Of 44 metals analyzed by neutron activation and atomic absorption spectrophotometry, 9 (Ag, Au, Cd, Cr, Cu, Pb, Sb, V, and Zn) showed increased rates of deposition in the last 30 years. These increases are attributed to increased rates of atmospheric deposition. Similar results were obtained from cores of Honnedaga Lake (Adirondack State Park) and Lake of the Clouds (Mt. Washington, New Hampshire). (Sims-ISWS)
W79-08581

THE QUESTION OF NITRIFICATION IN THE PASSAIC RIVER, NEW JERSEY: ANALYSIS OF HISTORICAL DATA AND EXPERIMENTAL INVESTIGATION,
Rutgers-The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
J. Cirello, R. A. Rapaport, P. F. Strom, V. A. Matulewich, and M. L. Morris.
Water Research, Vol. 13, No. 6, p 525-537, 1979. 10 fig, 6 tab, 23 ref. OWRT A-053-NJ(2).

Descriptors: *Nitrification, *Rivers, *New Jersey, Nitrogen, Nitrogen compounds, Nitrates, Ammonia, Ions, Anions, Cations, Sampling, Chemical analysis, Bacteria, Plankton, Nutrients, Pollutants, Pollutant identification, *Passaic River(NJ).

Historical NH4(+) and NO3(-) data from 6 stations on the Passaic River, New Jersey, were analyzed. The data for 5 of the stations span 1963 to 1976, and for the 6th station, 1947 to 1976. Some of the conclusions reached are as follows: (1) The concentration of NH4(+) fluctuated widely, but the trend was towards an increase with time. (2) The concentration of NH4(+) was elevated during a period of extreme drought (1963 to 1966). (3) The concentration of NO3(-) tended to increase smoothly with time. (4) The concentration of NH4(+) increases longitudinally (with downstream travel). (5) The loads (concentration x stream-flow) of both nitrogen species tended to increase with time. (6) Substantial NO3(-) enters the stream from non-point sources. (7) The potential for instream nitrification is not fully realized, as represented by elevated levels of NH4(+). The analyses were discussed from a regulatory perspective. It was concluded that the nitrification component of the Passaic's self-purification capacity is overburdened, and first became so in 1953. (Sims-ISWS)
W79-08582

COASTAL WATER RESEARCH PROJECT: ANNUAL REPORT FOR THE YEAR 1978,
Southern California Coastal Water Research Project, El Segundo.
1979 Bascom, W., Ed. 246 p, 65 fig, 42 tab, 99 ref, 4 append.

Descriptors: *Coasts, *Water pollution, *Pollutant identification, Benthic fauna, Aquatic life, Aquatic animals, Infaunal index, Research and development, Data collections, Marine animals, Water pollution effects, Water pollution sources.

Information is presented on research projects that were successfully completed in 1978 by the staff of the Southern California Coastal Water Research Project. The research centered on pollution in coastal waters: (1) identifying polluted areas on the bottom by using the condition of the bottom and the benthic infauna; (2) obtaining a knowledge of what normal conditions in any coastal area should be; (3) taking many measurements, and examining and plotting data on possibly polluted areas and extending into undisturbed regions; and (4) developing a data-based system of logic for selecting the boundaries between areas that are normal, changed, and degraded. The Infaunal Index is presented as a new monitoring method which uses a simple number to describe the condition of the community of small animals that live in the bottom. The characteristics of the present and future wastewater discharges in southern California are summarized. The biological consequences of a changing environment are examined for the coastal area for the last ten years. (Schaefer-IPA)
W79-08585

RADIOMETRIC METHOD FOR THE DETERMINATION OF URANIUM IN WATER: SINGLE-LABORATORY EVALUATION AND INTERLABORATORY COLLABORATIVE STUDY,
Mound Facility, Miamisburg, OH.
C. T. Bishop, V. R. Casella, and A. A. Glosby.
Report No. EPA-600/7-79-093, April 1979. Prepared for the Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada. 48 p, 11 tab, 16 ref, 4 append. EPA-1AG-D6-0015.

Descriptors: *Uranium radioisotopes, *Laboratory tests, Water pollution control, Radioisotopes, Water pollution sources, Precipitation(Chemical), Methodology, Testing procedures, Analytical techniques, Radioactivity techniques, Waste identification.

The results of a single-laboratory evaluation and an interlaboratory collaborative study of a candidate method for determining the concentration of urani-

um isotopes in water are presented. The procedure consisted of coprecipitation of uranium with ferrous hydroxide because this method was easy, fast, and gave a high recovery. A nitric-hydrofluoric acid dissolution was used in the sample contained sediment. The uranium was separated from other elements present by anion exchange chromatography and underwent subsequent electrodeposition on stainless steel slides. Alpha pulse-height analysis was used for counting the uranium activity. Four reference samples, ranging up to 2,000 disintegrations/minute/liter were prepared for procedure evaluation and for use in the collaborative study. Results of the collaborative study agreed with the reference values to within 5% in the case of higher level samples. Chemical recoveries averaged about 70%. The method was shown to be relatively simple and accurate. (Schaefer-IPA)
W79-08600

WATER QUALITY GUIDELINES FOR ACID MINE DRAINAGE AND STRIP MINE AREAS IN IOWA,
Energy and Mineral Resources Research Inst., Ames, IA. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5B.
W79-08611

RATE OF AVAILABILITY OF TOTAL PHOSPHORUS IN RIVER WATERS,
West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W79-08626

RELATIONSHIP BETWEEN SUMMER MEAN AND MAXIMUM CHLOROPHYLL A CONCENTRATIONS IN LAKES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. A. Jones, W. Rast, and G. F. Lee.
Environmental Science and Technology, Vol. 13, No. 7, p 869-870, July 1979. 1 fig, 1 tab, 6 ref.

Descriptors: *Chlorophyll, *Lakes, *Regression analysis, Equations, Average, Phosphorus, Secchi disks, Data processing, Eutrophication, Mesotrophy, Oligotrophy, Water bodies, Summer, Algae, Water quality, Water pollution, Maximum chlorophyll, Mean chlorophyll, Relationships.

Based on literature values from approximately 50 water bodies, an empirical relationship has been developed between the summer mean and summer maximum chlorophyll a levels in water bodies. Where chlorophyll is expressed in micrograms/liter, this relationship is: maximum = 1.7 (mean) + 0.2. (Sims-ISWS)
W79-08628

ENVIRONMENTAL EFFECTS OF WESTERN COAL COMBUSTION PART I - THE FISHES OF ROSEBUD CREEK, MONTANA,
Montana Fish and Game Dept., Miles City.
A. A. Elser, and J. C. Schreiber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 882, Price codes: A03 in paper copy, A01 in microfiche. U. S. Environmental Protection Agency, Report EPA 600/3-78-098, 34 p, 1978. 8 fig, 11 tab, 17 ref.

Descriptors: *Montana, *Rosebud Creek, *Fort Union Coal Basin, Coal mines, Coal combustion, Mining, Biological communities, *Freshwater fish, *Fish populations, Fish reproduction, Fish management, Environmental effects, Planning, Biological surveys, Energy.

Fish populations have been studied during 1975 and 1976 in Rosebud Creek, a prairie stream which flows through the Fort Union Coal Basin in southeastern Montana. The objectives of this study was to collect fish population data to determine any immediate effects, and to act as a yardstick for assessing possible future effects of accelerated activities of coal mining and coal combustion in this region. Fishes were inventoried at nine stations and included 21 species representing nine families. Fish species diversity increased in a downstream direction, and tributaries contained many of the same fish species as in Rosebud Creek. The seasonal occurrence of reproductively mature game fishes in the lower region of Rosebud Creek suggests that it is used for spawning by fishes from the Yellowstone River. During the study, there was no apparent effect of either coal mining or coal combustion activities on the distribution of fishes in Rosebud Creek. (See also W79-08658) (Katz-EIS)
W79-08657

ENVIRONMENTAL EFFECTS OF WESTERN COAL COMBUSTION PART II - THE AQUATIC MACROINVERTEBRATES OF ROSEBUD CREEK, MONTANA,
Montana State Univ., Bozeman. Dept. of Biology.
S. F. Baril, R. J. Luedtke, and G. R. Roemhild.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 211, Price codes: A05 in paper copy, A01 in microfiche. U. S. Environmental Protection Agency, Report EPA 600/3-78-099, 74 p, 1978. 13 fig, 17 tab, 59 ref.

Descriptors: *Montana, *Rosebud Creek, *Fort Union Coal Basin, *Colstrip, *Coal mines, Coal combustion, Mining, Biological communities, Environmental effects, Water pollution effects, Biological survey, Energy, Benthos, *Aquatic insects, Coal fired power plants, Turbidity, Suspended solids, Faunal variation.

The aquatic macroinvertebrates of Rosebud Creek, Montana, were sampled between February 1976 and March 1977 to provide data on their abundance, distribution, and diversity. The sampling program was initiated during the first year of operation of the coal-fired power plants located at Colstrip, Montana. The purpose of the study was to determine if any immediate impacts of the power plant operation on the macroinvertebrate communities of Rosebud Creek could be detected and to provide data for comparisons with future studies. Rosebud Creek supported a diverse bottom fauna with high population numbers composed of species adapted to the turbid, silty conditions which are common in the prairie streams of eastern Montana. Intact riparian vegetation appeared to be important in maintaining stream bank stability and provided an essential food source. It was concluded that faunal variation among sampling stations during the study period was attributable to physical factors including turbidity, water temperature, current velocity, and substrate, and not to potential impacts from coal mining and combustion. (See also W79-08657) (Katz-EIS)
W79-08658

THE ACUTE TOXICITY OF ZINC TO RAINBOW AND BROOK TROUT, COMPARISONS IN HARD AND SOFT WATER,
Environmental Research Lab., Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-08659

CHANGES IN PLANKTON AND BENTHOS OF THE SEA OF AZOV UNDER THE INFLUENCE OF ANTHROPOGENIC FACTORS,
Azovskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Rostovna-Donu (USSR).
V. P. Zakutskiy, A. Ya. Aldakimora, L. I. Tolokonnikova, G. S. Gunia, and V. A. Kopets.
Hydrobiological Journal, Vol. 14, No. 1, p 22-27, 1978. 14 ref (Translated from Russian).

Descriptors: *Salinity, *Dams, Hydrology, Plankton, Benthos, *Don River, *USSR, Sea of Azov, Nutrients, Gulf of Taganrog, Commercial fisheries, Fish management, Microbiology, Microflora, Phytoplankton, Zooplankton, Zoobethos, Mollusks, Animal populations.

Damming of the Don River in the USSR has decreased the inflow of freshwater and nutrient salts into the Sea of Azov and consequently, increased the salinity of water in the Sea itself and in the Gulf of Taganrog. Food availability decreased at all levels of the food chain and the structure of plankton and benthos coenoses was altered. Black Sea species of little value began to penetrate into the Sea of Azov. Regulation of the water supply through the Kerch Strait and intensification of fish breeding work are therefore essential measures for the protection of this unique body of water. Changes in composition of the microflora, phytoplankton, zooplankton and zoobenthos are described. (Katz-EIS)
W79-08660

A NEW UNITED STATES BIOMONITORING SYSTEM FOR THE AQUATIC ENVIRONMENT,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
L. P. Braginskiy.
Hydrobiological Journal, Vol. 14, No. 1, p 63-68, 1978. 4 ref. (Translated from Russian).

Descriptors: Fresh water, *Monitoring, *Bio-monitoring, *BIO-STORET, Toxicity, Analytical techniques, Aquatic environment, Aquatic populations, Methodology, Data collections, Data processing, *Data storage and retrieval, Data transmission, Water quality, Modelling, On-site-investigations.

The main principles of a new system (BIO-STORET) for monitoring the water environment, developed and tested in the United States, are described. The system is based on biotests which measure a set of hydrobiological and toxicological characteristics of aquatic ecosystems. A digital code for fresh and salt water biota and a system for the transmission of encoded information have been devised. The data processing center uses 300 computers. The data obtained are used widely for monitoring water quality and to forecast possible changes in aquatic ecosystems. (Katz-EIS)
W79-08661

PHYTOPLANKTON IN THE NOVO-BAVARSKOYE RESERVOIR AS AN INDICATOR OF TYPE AND THE BIOLOGICAL-SANITARY CONDITION OF A LAKE,
Kharkov State Univ. (USSR).
R. P. Zhupanenko, and A. V. Basina.
Hydrobiological Journal, Vol. 14, No. 1, p 68-71, 1978. 18 ref. (Translated from Russian).

Descriptors: *Reservoirs, Dams, Water supply, *Kharkov, *USSR, Udy River, Phytoplankton, Water quality, Biomass, *Primary productivity, Plankton, Phytoplankton, Distribution. Saporobic activities, Seasonal changes, Water pollution effects, Nutrients, Nova-Bavarskoye Reservoir.

Data are presented on the morphology and hydrology of the Novo-Bauarskoye reservoir, built in 1970 within the city limits of Khar'kov for the purposes of improvement of the city's water supply. Also given are data on the chemical composition of its water, as well as the species composition, abundances and biomass of phyto-plankton found in it. Seasonal changes in phytoplankton and irregularities in its distribution through the reservoir are noted. The waters of the Novo-Bavarskoye Reservoir can be classified as mesosaprobic with low saprobial activity in summer and high activity in winter. The water is of the best quality in the winter. (Katz-EIS)
W79-08662

DETERMINATION OF PENTACHLOROPHENOL IN MARINE BIOTA AND SEA WATER BY GAS-LIQUID CHROMATOGRAPHY AND HIGH-PRESSURE LIQUID CHROMATOGRAPHY,
Environmental Research Services, Gulf Breeze, FL.
L. F. Faas, and J. C. Moore.
Journal of Agricultural and Food Chemistry, Vol 27, p 554-557, 1979. 1 fig, 3 tab, 18 ref.

Descriptors: Water pollution effects, Path of pollutants, Phenols, *Pentachlorophenol, *Mullets, *Shrimp, *Oysters, Mugil, Palaemonetes, Crassostrea, *Methodology, Chemical analysis, Tissue concentration, Sea water, Chromatography, Laboratory tests, Detection limits, Tissue analysis

A method is described for measuring pentachlorophenol (PCP) in samples from the estuarine envi-

ronment. Gas-liquid chromatography (GLC) is used to determine PCP residues in tissues as low as 0.01 ppm. Application of the method to exposed organisms indicates that PCP accumulates in mullet (Mugil cephalus), grass shrimp (Palaemonetes pugio), and eastern oysters (Crassostrea virginica). Sea water concentrations as low as 0.002 ppb may be detected by formation of the amyl diazohydrocarbon derivative. Ultraviolet detection limits for PCP by LC are 5.0 ppm in tissues and 2.0 ppb in seawater. (Katz-EIS)
W79-08664

THE WEST FALMOUTH OIL SPILL: HYDROCARBONS IN THE SALT MARSH ECOSYSTEM,
Victoria Ministry for Conservation, Melbourne (Australia).
K. A. Burns, and J. M. Teal.
Estuarine and Coastal Marine Science, Vol. 8, p 349-360, 1979. 3 fig, 3 tab, 21 ref.

Descriptors: Water pollution effects, Path of pollutants, *Oil, *Oil spills, Sediments, Marshes, Marine animals, *West Falmouth, Massachusetts, *West Falmouth oil spill, Salt Marsh Coast, Marine fish, Chemical analysis, No 2 fuel oil, Petroleum hydrocarbons, Marsh plants, Fundulus, Uca, Allkanes, Naphthenes.

Marsh surface sediments, cores, and organisms were analysed for hydrocarbons from one to seven years after the spill in September 1969 of No. 2 fuel oil at West Falmouth, Massachusetts. All organisms analysed showed contamination initially. Fundulus were nearly free of oil after one year but Uca remained heavily contaminated for at least four years. Alkanes disappeared in sediments after about 4 years while heavy aromatics and naphthenes persisted throughout the study. (Katz-EIS)
W79-08666

LEAD ACCUMULATION IN AQUATIC PLANTS FROM METALLIC SOURCES INCLUDING SHOT,
Montana Univ., MO. Dept. of Botany.
M. J. Behan, T. B. Kincaide, and W. I. Selser.
Journal of Wildlife Management, Vol. 43, No. 1, p 240-244, 1979. 3 tab, 13 ref.

Descriptors: *Lead, *Path of pollutants, *Animal pathology, Toxicity, Heavy metals, Waterfowl, Aquatic plants, Absorption, Mallard Duck, Rooted aquatic plants, Plant physiology, Water pollution sources, Water pollution effects.

Ingestion of lead shot has caused the deaths of thousands of waterfowl during the past several decades. Plants absorb lead from diverse sources such as lead additives in engine fuels released into the atmosphere and geologic deposits of lead. The authors attempted to determine if rooted aquatic plants could absorb enough lead supplied in metallic form to be a potential cause of plumbism in waterfowl. In several different experiments the authors found that even though rooted aquatic plants can absorb lead from soils containing metallic lead or lead shot, they do not appear to accumulate lead in concentrations sufficiently high to be a dietary factor leading to plumbism. The authors' results indicate that those factors involving the availability, ingestion, and absorption of lead directly from shot should continue to occupy the primary attention of those investigating the etiology of plumbism in waterfowl. (Deal-EIS)
W79-08670

PECULIAR ACCUMULATION OF COBALT-60 BY THE BRANCHIAL HEART OF OCTOPUS,
National Inst. of Radiological Sciences, Nakaminato (Japan). Marine Radio-Ecological Research Station.
M. Nakahara, T. Koyanagi, T. Ueda, and C. Shimizu.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 539, 1979. 1 tab, 3 ref.

Descriptors: *Cobalt radioisotopes, *Absorption, *Animal physiology, *Bioaccumulation, *Octopus, *Japan, *Tissue analysis, Cobalt, Radioactivity techniques, Tracers, Path of pollutants, Water chemistry, Radiochemical analysis, Animal metabolism.

Octopus (Octopus vulgaris) were exposed to 0.5 uCi/L Cobalt-60 for 30 days. Following exposure various tissues were analyzed for radioactivity using a well-type scintillation detector Among the tissues and organs measured, branchial heart showed the highest affinity for Cobalt-60. The affinity decreased in the following order: gill, liver, kidney and others. The concentration factors of the branchial heart, gill, liver and kidney were 24,000, 480, 240 and 230, respectively. The branchial heart did not show a high affinity for cesium-137 in a previous experiment. (Deal-EIS)
W79-08671

EXPERIMENTAL INTENSIVE CULTURE OF TIGER MUSKELLUNGE IN A WATER REUSE SYSTEM,
Michigan Dept. of Natural Resources, Mattawan. Wolf Lake State Fish Hatchery.
C. H. Pecor.
The Progressive Fish Culturist, Vol. 41, No. 2, p 103-108, 1979. 4 fig, 2 tab, 10 ref.

Descriptors: *Water reuse, *Growth rates, *Aquiculture, *Pikes, Fish physiology, Water chemistry, Recirculated water, Dissolved oxygen, Hydrogen ion concentration, Ammonia, Fish hatcheries, Fry, Tiger muskellunge.

Tiger muskellunge 14.5 cm long were reared for 45 days in a three-pass (pass I, II, and III) water reuse system. Cumulative growth rates for the fish were 0.143 cm/day in the first use of the water (pass I), 0.125 in the second use (pass II), and 0.108 in the third use (pass III). Food conversions were poorer in passes II and III. Survival of fish in each pass was good and no abnormal mortalities or disease problems were encountered. Dissolved oxygen, ammonia, and pH data indicated that oxygen consumption and ammonia production had daily minimum values between 0200 and 0600 h and maximum values between 1600 and 2000 h. Maximum un-ionized ammonia levels of 0.0172 mg/L were recorded in pass III. Average daily oxygen consumption and ammonia production rates were 97 g oxygen per kilogram of food fed (97 g oxygen/per 3400 kcal) and 6 g ammonia per kilogram of food fed and were substantially lower than corresponding rates reported for salmonids. (Deal-EIS)
W79-08672

DETERMINATION OF TRACE ELEMENTS IN MARINE ORGANISMS-II RELATIONSHIP BETWEEN THE BODY SIZE OF SARGASSUM HORNERI AND CONCENTRATION OF IRON (IN JAPANESE),
National Inst. of Radiological Sciences, Nakaminato (Japan). Marine Radio-Ecological Research Station.
T. Ishii, M. Iimura, and T. Koyanagi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 459-464, 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Iron, *Growth rates, *Phaeophyta, *Japan, *Tissue analysis, Trace elements, Metals, Size, Weight, Plant physiology, Chemical analysis, Seasonal.

The concentration of iron in the brown algae, Sargassum horneri, of various growing stages collected on the coast of Ibaraki prefecture was determined to examine the relationship between body size and concentration of iron. The concentrations of iron showed significant differences among 45 samples and ranged from 66 to 640 micrograms/g dry weight. The concentration in algal bodies as well as in each organ of the algae tended to decrease remarkably with increasing body size. The distribution of iron among the organs of Sargassum horneri was not homogeneous; lamina showed the highest concentration of iron. The basal lamina of the main stipe accumulated iron about five times higher than the upper lamina of the branch around the growing point. Variation in weight percent of each organ to body weight was observed with increasing body size and the weight percent of lamina tended to decrease exponentially. (Deal-EIS)
W79-08673

HEAVY METAL CONTENTS IN DEEP-SEA FISHES (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan). Lab. of Food Hygienic Chemistry.
R. Kobayashi, E. Hirata, K. Shiomi, H. Yamanaka, and T. Kikuchi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 4, p 493-497, 1979. 4 fig, 1 tab, 16 ref. (English summary).

Descriptors: *Heavy metals, *Absorption, *Fish physiology, *Tissue analysis, *Bioaccumulation, *Arsenic, *Selenium, Mercury, Cadmium, Zinc, Lead, Chemical analysis, Commercial fishing, Depth, Public health, Deep water habitats, Marine fish, Methyl mercury.

In order to examine whether deep-sea fishes were safe to eat, heavy metal contents were determined in the muscles of 16 species caught off New Zealand and Patagonia. Heavy metal contents determined in the muscles of deep-sea fishes were as follows: 0.04 to 0.46 ppm of total mercury, 0.02 to 0.44 ppm of methyl mercury, 0.08 to 0.46 ppm of selenium, trace to 0.03 ppm of cadmium, 4.3 to 10.9 ppm of zinc, trace to 0.53 ppm of lead, and 0.12 to 9.99 ppm of arsenic. The mercury contents of dory, Cyttoidopus sp., and Tarakihi, Cheilodactylus macropterus, exceeded the temporary regulatory level of mercury in fishes and shellfishes. The contents of selenium, cadmium, zinc, and arsenic in the muscles of deep-sea fishes were about the same as those of commercial fishes, but lead was present at somewhat higher levels in the muscles of deep-sea fishes. In the muscle of dory, the amounts of total mercury and methyl mercury were found to be proportional to body weight. There exists a significant correlation between the depth of the sea where the fishes are caught and the contents of total mercury in the muscles, that is, the deeper the fishes live, the higher the contents of total mercury found in these fishes. (Deal-EIS)
W79-08674

NEW FLOATING TRAP FOR CAPTURING AND PRESERVING EMERGING AQUATIC INSECTS,
Columbia National Fisheries Research Lab., MO.
T. P. Boyle.
The Progressive Fish Culturist, Vol. 41, No. 2, p 108-109, 1979. 1 fig, 11 ref.

Descriptors: *Research equipment, *Aquatic insects, *Species diversity, *Monitoring, On-site investigations, On-site data collections, Sampling, Insects, Growth stages, Aquatic populations, Life history, Studies, Secondary productivity, Analytical techniques.

Several studies in which the efficiency of different types of emergence traps was compared showed that floating traps caught the greatest number and diversity of species. The frame construction of the emergence trap described here is like that of a pyramid trap. The frame is covered with a sheet of clear polyethylene. The collecting portion of the trap is based on a modified Malaise design. Thirty-six floating pyramid traps with the newly designed collecting device were tested in 12 ponds. The traps were serviced weekly with adequate results. No insects, dead or alive, were found outside the collecting jar. Although the traps have survived high winds, rain, and hail with no damage, their use probably should be restricted to calm waters. The trap is selective only against insects too large to enter the holes around the top of the funnel, such as dragonflies; larger insects may be accommodated by enlarging the holes. (Deal-EIS)
W79-08675

TOXICITY OF SWASCOL (TRADE NAME) 1P (SLS) TO CHANNA PUNCTATUS AND CIRRHINA MRIGALA: BIOCHEMICAL ALTERATIONS,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.

S. R. Verma, N. Pal, A. K. Tyagi, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 711-718, 1979. 3 tab, 29 ref.

Descriptors: *Toxicity, *Detergents, *Fish physiology, *Enzymes, *Channa, *Cirrhina, *Swascol, *Tissue analysis, Sulfates, Inhibition, Biochemistry, Animal metabolism, Chemical analysis, Mode of action, Chemical wastes, Anionic detergent.

Freshwater teleosts (Channa punctatus and Cirrhina mrigala) were exposed to the syndet Swascol 1P with active matter sodium lauryl suphate (SLS), an anionic detergent, for 15 and 30 day time intervals. Following exposure the fish were sacrificed and the liver and kidney were analysed for enzyme activity of acid and alkaline phosphatases and succinic dehydrogenase. It was found that exposure inhibited enzyme activity. The response of acid and alkaline phosphatases were quite similar and dose dependent. Low exposure levels stimulated succinic dehydrogenase activity while high levels caused inhibition. Possible pathways for the actions of the chemical were also discussed. (Deal-EIS)
W79-08677

EFFECT OF THERMAL EFFLUENTS AND RETENTION TIME ON LAKE FUNCTIONING AND ECOLOGICAL EFFICIENCIES IN PLANKTON COMMUNITIES,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
A. Hillbricht-Ilkowska, and B. Zdanowski.
Internationale Revue der gesamtem Hydrobiologie, Vol. 63, No. 5, p 609-617, 1978. 7 fig, 1 tab, 10 ref.

Descriptors: *Freshwater, Lakes, *Animal populations, *Phytoplankton, Biomass, *Primary productivity, Zooplankton, Cladocera, Water temperature, Thermal pollution, Thermal power plant, Thermal stress, Cladocera, Komin Lake Complex, *Poland, On-site-investigation, Nutrients.

The following changes were observed in three lakes as a result of their heating and decrease of retention time (data for summer periods): increase of mixing rate, active bottom area, and nutrients, concentrations; significant changes in gross primary production, phytoplankton biomass and production of filtering cladocerans. These changes seem to indicate the higher efficiency of utilization of autochthonous trophic resources and energy transfer in plankton. There was a strong increase in the biomass of cladocerans. Lakes received the thermal effluent of powerplants. (Katz-EIS)
W79-08678

EFFECT OF OXYGEN SUPPLY IN CONCRETE PONDS ON ENVIRONMENTAL FACTORS AND PRODUCTION OF FISH BY FEEDING (IN JAPANESE),
Freshwater Fisheries Research Lab., Tokyo (Japan).
Y. Satomi, T. Maruyama, and Y. Furuta.
Bulletin of the Freshwater Fisheries Research Laboratory, Vol. 28, No. 2, p 169-187, 1978. 13 fig, 5 tab, 14 ref. (English summary).

Descriptors: *Oxygen requirements, *Fish farming, *Growth rates, Tilapia, Carp, Fish harvest, Water temperature, Dissolved oxygen, Nutrients, Nitrites, Weight, Carbon, Nitrogen, Phosphorus, Aquiculture.

This study examined the effects of an artificial oxygen supply on fish production and the ecological dynamics in pond water. Identical ponds served as the experimental units. Carp and tilapia were stocked in each pond at rates of 44 kg and 19 kg per pond, respectively. An oxygen generator with a capacity of 1 cubic meter O2/hr was used. A device for mixing oxygen with water was installed in each pond. Water temperature, dissolved oxygen and transparency were monitored daily. The fish were harvested after four months. There were slight differences between the two ponds with regard to the seasonal fluctuation of abiotic and biotic factors. There were no fundamental differences which would influence fish production, except the higher concentration of nitrite in the carp pond. The estimated carbon, nitrogen and phosphorus budgets in the ponds revealed significant low recovery of nitrogen and carbon. The amount unrecovered was larger in the carp pond than in the tilapia pond. At the end of the experiment, the increase of body weight was 3 kg and 2 kg/square meter or for carp and tilapia, respectively. The growth rate and feed efficiency of tilapia were superior to those of carp. It may be concluded from the results of this investigation that the oxygen supply in the ponds was very efficient in achieving higher fish production in spite of the higher concentration of nitrite in the water. (Deal-EIS)
W79-08680

DETERMINATION OF TOTAL ORGANIC NITROGEN AND ORGANO-METALLIC NICKEL IN OIL, SEDIMENTS AND MARINE PRODUCTS,
Osaka Prefecture Inst. of Public Health (Japan). Lab. of Food Chemistry.
A. Nakamura, and T. Kashimoto.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 345-349, 1979. 4 tab, 8 ref.

Descriptors: *Nickel, *Nitrogen compounds, *Oil, *Tissue analysis, Oil spills, Path of pollutants, Oil pollution, Chemical analysis, Gas chromatography, Clams, Bottom sediments, Benthic fauna, Analytical techniques, Oysters, Marine benthos.

The organometallic nickel and organic nitrogen compounds found in heavy oil are infrequently analyzed due to the need for sensitive detection equipment. This study utilized high pressure liquid chromatography and gas liquid chromatography with a nitrogen selective detector to analyze oil, sediments and marine products for the presence of these compounds. Data suggested that oil types have distinctive 'fingerprints' of nickel/nitrogen ratios which could be used to identify oil in sediments and marine biota after an oil spill organometallic nickel in various molluscs was determined. (Deal-EIS)
W79-08681

COMPARATIVE STUDY OF 85SR AND 90SR CONCENTRATION AND ELIMINATION IN CARASSIUS AURATUS GIBELIO,
Department of Radiobiology, Bucharest (Romania).
I. Chiosila, and E. Reviu.
Revue Roumaine de Biologie, Vol. 23, No. 2, p 125-128, 1978. 2 fig, 8 ref.

Descriptors: *Fish physiology, *Strontium radioisotopes, *Carassius, *Tissue analysis, *Elimination, Goldfish, Radiochemical analysis, Tracers, Absorption, Water chemistry, *Strontium, Food chains, Trophic level, Path of pollutants, 85Sr, 90Sr.

This paper presents several experiments concerning the concentration in Carassius auratus gibelio of 85Sr and 90Sr from contaminated waters with 1,200 pCi/ml. Concentration of the two radionuclides in fish, after a month's contamination, is almost identical, the concentration factors amounting to 10. The elimination of 85Sr and 90Sr from fish bodies takes place with the same Tb (136 days), while Te takes about 44 days for 85Sr and 136 days for 90Sr. (Deal-EIS)
W79-08682

HYDROCARBON POLLUTANTS FROM STATIONARY SOURCES,
Radian Corp., Austin, TX.
E. C. Cavanaugh, M. L. Owen, T. P. Nelson, J. R. Carroll, and J. D. Colley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 784, Price codes: A15 in paper copy, A01 in microfiche. Report EPA-600/7-77-110, 1977. 317 p. 22 fig. 63 tab, 131 ref. 1 append.

Descriptors: *Reviews, *Data collections, *Organic compounds, *Water pollution sources, *Agriculture, Chemical industry, Industrial wastes, Oil industry, Waste disposal, Waste water treatment

A review is presented of stationary sources of hydrocarbon pollutants which includes descriptions of major sources and estimates of the quantities emitted. Volatile emissions and effluents are considered. Fifty percent of the process organic effluents are from agricultural and forest products, and 47% are from chemical processing. Thirty-five percent of the remaining effluents are considered controllable. Twenty-nine percent could be controlled with tertiary control of municipal waste water treatment facilities. The organic content of water effluents is estimated from information on BOD, COD, and TOC. The following sources are included: fossil fuel extraction; fossil fuel processing; fossil fuel transportation, marketing, and storage; fossil fuel refining; fossil fuel combustion; organic chemical processing; noncombustion organic chemical utilization; agricultural and forest products; natural sources; solid waste disposal; and municipal waste water treatment. (Small-FRC)
W79-08741

EVALUATION OF LEACHATE TREATMENT VOLUME I. CHARACTERIZATION OF LEACHATE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. S. K. Chian, and F. B. DeWalle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 885, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/2-77-186a, 1977. 225 p, 47 fig, 18 tab, 212 ref.

Descriptors: *Leachate, *Landfills, *Chemical analysis, *Organic compounds, *Membrane processes, Permselective membranes, Biodegradation, Metals, Waste water treatment, Municipal wastes.

Leachate from landfills located in various regions of the U.S. was analyzed for organics and inorganics as a preliminary to an evaluation of treatment alternatives. The separation of molecular weight fractions and the determination of primary classes of organics and functional groups was conducted with membrane ultrafiltration, gel-permeation chromatography, and specific organic analyses. Most of the organics were low molecular weight as evidenced by their ability to permeate a 500 molecular weight ultrafiltration membrane. Leachate samples exhibited a decrease of free volatile fatty acid fraction with increasing landfill age, as calculated from membrane fractionation and organic analyses. Sequential removal of organics from biological degradation studies followed the order of: high molecular weight humic carbohydrate-type organics; free volatile fatty acids; bacterially excreted carbonyl compounds and amino acids; and high molecular weight carbohydrates produced during the third phase. Most of the metals also permeated the membrane, indicating that chelation by refractory organics has a minor role in metal attenuation processes. Iron was an exception and was associated primarily with the 100,000 molecular weight retentate. Volume II contains results of bench-scale treatment process investigations. (Lisk-FRC)
W79-08774

AREAWIDE ASSESSMENT PROCEDURES MANUAL. VOLUME I,
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 864, Price codes: A99 in paper copy, A01 in microfiche. Report EPA-600/9-76-014-1, 1976. 655 p, 86 fig, 84 tab, 216 ref. 10 append.

Descriptors: *Assessments, *Evaluation, *Publications, *Analytical techniques, *Water pollution control, Water quality, Urban hydrology, City planning, Pollutant identification

A summary is presented of available procedures and methodologies for the identification and estimation of pollutant load generation and transport from major sources within water quality manage-

ment planning areas. The major emphasis is on the assessment of urban problems and the selection of alternatives in urban areas. There is some coverage of non-urban loads. Methodologies are also included for the assessment of present and future water quality impacts from major sources. There are also summaries of available information and techniques for the analysis of a selection of structural and non-structural control alternatives. This manual is designed to present problem assessment and impact analysis approaches at several levels of planning. Simple procedures are recommended to develop understanding of the problem and to assist in the application of complex techniques. (See also W79-08798 and W79-08799) (Small-FRC)
W79-08797

AREAWIDE ASSESSMENT PROCEDURES MANUAL. VOLUME II,
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 865, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/9-76-014-2, 1976. 129 p, 6 tab, 37 ref.

Descriptors: *Assessments, *Mathematical models, *Land use, *Data collections, City planning, Analytical techniques, Computer models, Statistics, Water quality, Water pollution sources.

Two appendices are presented for the Areawide Assessment Procedures Manual. The manual provides a guide to available procedures and methodologies for the identification and estimation of pollutant loads. Appendix A is the model applicability summary. Drainage models include STORM, SWMM, HSP, MICAT, HVM-QQS, Metcalf and Eddy, AGRUN, ILLUDAS, DOSAG-1, QUAL-II, RECEIV, RECEIV-II, SRMSCI, WRECEV, HWQM, and LAKECO. Appendix C is on land use data collection and analysis. A description is provided of a range of land use and demographic data collection, management, and analysis techniques. Emphasis is on the identification of land use data needs, identification of existing data sources and characteristics, the matching of data needs with available data sources, and collection of land use data. (See also W79-08797) (Small-FRC)
W79-08798

AREAWIDE ASSESSMENT PROCEDURES MANUAL, VOLUME III,
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 866, Price codes: A99 in paper copy, A01 in microfiche. Report EPA-600/9-76-014-3, 1976. 590 p, 145 fig, 25 tab, 2561 ref.

Descriptors: *Assessments, *Storm water, *Urban runoff, *Overflow, *Water pollution control, Sewerage, Water quality, Water pollution control, Performance, Costs.

Appendices are presented for the Areawide Assessment Procedures Manual. The manual provides a guide to available procedures and methodologies for the identification and estimation of pollutant loads. Appendix G is presented which deals with the performance and cost of urban stormwater management techniques. Part 2 of Appendix G is a paper intitled Stormwater Management Model: Level 1, Comparative Evaluation of Storage-Treatment and Other Management Practices by James P. Heaney and Stephan J. Nix. This report describes simplified procedures which yield estimates of the magnitude of sewer overflows and stormwater discharges and the associated costs of control. Appendix H deals with point source control alternatives and their performance and cost. Extensive references are included. (See also W79-08797) (Small-FRC)
W79-08799

TRACE METAL DISCHARGES OF THE GRAND CALUMET RIVER,
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
R. R. Romano, A. W. McIntosh, W. V. Kessler, V. Anderson, and J. M. Bell.
Journal of Great Lakes Research, Vol. 3, No. 1-2, p 144-147, 1977. 1 fig, 4 tab, 10 ref. NSF-RANN GI-35106.

Descriptors: *Grand Calumet River(IN IL), *Trace elements, *Heavy metals, *Lake Michigan, *Water pollution sources, *Pollutants, *Industrial wastes, *Municipal wastes, Rivers, Canals, Indiana Harbor Canal(IN), Chicago(IL), Indiana, Illinois, Great Lakes, Lakes, Cadmium, Iron, Zinc, Lead, Sediments, Water supply, Path of pollutants, On-site investigations.

The Grand Calumet River system is a major fluvial source of heavy metals to Lake Michigan through its outlet, the Indiana Harbor Canal. Sampling conducted at three bridge sites on the river's western and eastern arms and on the canal from November 1974-October 1975 showed that levels of cadmium, lead, zinc, and iron in sediments generally exceed values reported in the literature for other polluted systems, while levels in water are less elevated. Total metal discharge from the river exhibits the following descending order: Fe Zn Pb Cd. Significant amounts of the filterable lead fraction (about 10 tons/yr) are discharged through the canal. Even if industrial and municipal sources of trace metals were controlled throughout the system, current metal loads in the Grand Calumet River might threaten water quality in Lake Michigan's southern basin (especially in the Chicago area) for many years. Several cities use the lake as a source of drinking water. Eight major industries and three large municipal sewage treatment plants located along the river and canal contribute trace metals. Weighted averages of sediment concentrations for the three sites are 5.5 ppm dry wt for cadmium (range 3.13-7.85), 545 ppm for lead (208-811), 1390 for zinc (750-2060), and 42,000 for iron (27,000-61,900). In water weighted average concentrations are 1.0 ppb for cadmium (0.8-1.3), 23 ppb for lead (16-29), 70 ppb for zinc (57-80), and 1090 ppb for iron (750-1540). (Lynch-Wisconsin)
W79-08813

TRACE ELEMENTS IN SAMPLES OF FISH, SEDIMENT AND TACONITE FROM LAKE SUPERIOR,
Wisconsin Univ.-Madison. Dept. of Chemistry
R. J. Korda, T. E. Henzler, P. A. Helmke, M. M. Jimenez, and L. A. Haskin.
Journal of Great Lakes Research, Vol. 3, No. 1-2, p 148-154, 1977. 1 fig, 2 tab, 18 ref. NSF-RANN GR-29731.

Descriptors: *Taconite, *Fish, *Sediments, *Lake Superior, *Sculpin, *Trace elements, Great Lakes, Lakes, Cottus cognatus, Myoxocephalus quadricornis, Copper, Zinc, Manganese, Sodium, Arsenic, Mercury, Cobalt, Scandium, Cadmium, Selenium, Rare-earth elements, Tracers, Water pollution sources, Path of pollutants, Water pollution effects, Sediment-water interfaces, Minnesota, Silver Bay(MN), Tofte(MN), On-site investigations.

Neutron activation analysis of 27 trace elements in sculpin, sediment, and taconite tailings taken September 1972 from areas of Lake Superior with high and low concentrations of taconite tailings indicate that the presence of taconite does not significantly affect trace element concentrations in sculpin. Concentrations of all elements except manganese and arsenic are lower in tailings than in sediment, and concentrations of trace elements in the fish are similar between contaminated and control sites. Manganese and arsenic levels are five times higher in taconite than sediment. Samples were collected: (1) 10 km offshore from Silver Bay, Minnesota, where the bottom is covered by about four cm of taconite tailings, (sampling at depths of 180-250 m); and (2) at Tofte, Minnesota, about 130 km north of Silver Bay where only traces of taconite have been found. Flesh and livers samples of two sculpin species were tested, slimy sculpin (Cottus cognatus) and four-horned sculpin (Myoxocephalus quadricornis). Sculpin live and feed exclusively at the sediment-water interface. Elements analyzed were copper, zinc, manganese, sodium, arsenic, mercury, cobalt, scandium, cadmium, selenium, and the rare-earth elements. Low concentrations of most trace elements in taconite and similarity of their concentration ratios indicates that no elements measured in taconite are suitable tracers for taconite movement and distribution in Lake Superior. Possible sources of contamination of fish tissue samples are discussed. (Lynch-Wisconsin)
W79-08814

DEHYDROABIETIC ACID ACCUMULATION BY RAINBOW TROUT (SALMO GAIRDNERI) EXPOSED TO KRAFT MILL EFFLUENT,
Canada Centre for Inland Waters, Burlington (Ontario).
M. E. Fox, D. M. Whittle, and K. L. E. Kaiser.
Journal of Great Lakes Research, Vol. 3, No. 1-2, p 155-158, 1977. 1 fig, 1 tab, 16 ref.

Descriptors: *Rainbow trout, *Kraft mills, *Water pollution effects, *Dehydroabietic acid, *Bioaccumulation, *Fishkill, Salmo gairdneri, Pulp and paper industry, Lake Superior, Great Lakes, Nipigon Bay(Ontario-Canada), Ontario(Canada), Canada, Bays, Toxicity, Resin acids, Effluents, Industrial wastes, Sublethal effects, Water pollution sources, Poisons, Bioassay, Chromatography.

Rainbow trout (Salmo gairdneri) exposed to kraft mill effluent under laboratory conditions accumulate dehydroabietic acid (DHA) to a level likely to result in sublethal toxic effects. DHA is a resin acid constituent of pulp mill effluents derived from coniferous trees, known to be toxic to fish at mg/l concentrations and to persist in water and sediments. The upper Great Lakes are affected by pulp and paper mill effluents at several locations, and in some receiving waters fish populations have undergone drastic changes. Yearling rainbow trout of about 200 g each were obtained from a trout farm and acclimated two weeks to water of Nipigon Bay (northern Lake Superior), which has pH 7.8 and EDTA hardness 69 mg $CaCO_3$/l. Duplicate populations of 10 fish each were exposed to bleached kraft mill effluent concentrations of 18, 10, 6, and 3% V/V for 48-144 hrs on a continuous-flow basis. Whole fish were homogenized by grinding and analyzed for DHA. Levels of 2-10 mu-g DHA/g were found in the fih on a whole weight basis. Less than one mu-g DHA/g was found in control fish also acclimated in Nipigon Bay water for two weeks, and no residue was detected in an unexposed fish. Fish exposed to 3% effluent for 144 hrs accumulated less DHA than those exposed to higher concentrations for shorter periods. The mean concentration of DHA in the final kraft mill effluent used in the study was about 3.7 mg/l, and with the dilutions fish were exposed to levels of 0.1-0.7 mg/l, toxic to salmonid fish species. (Lynch-Wisconsin)
W79-08815

FORMS AND SEDIMENT ASSOCIATIONS OF NUTRIENTS (C,N, AND P.) PESTICIDES AND METALS, NUTRIENTS - P,
For primary bibliographic entry see Field 5C.
W79-08828

ANTHROPOGENIC INFLUENCES OF SEDIMENT QUALITY AT A SOURCE, NUTRIENTS: CARBON, NITROGEN AND PHOSPHORUS,
For primary bibliographic entry see Field 5C.
W79-08829

5B. Sources Of Pollution

HEAVY METAL ENRICHMENT IN MINE DRAINAGE: IV. THE ORANGE FREE STATE GOLDFIELD,
Pretoria Univ. (South Africa). Dept. of Chemistry
G. T. Wittmann, and U. Foerstner
South African Journal of Science, Vol. 73, No. 12, p 374-378, December 1977. 1 fig, 6 tab, 32 ref.

Descriptors: *Mine water, *Heavy metals, *Acid mine drainage, Acid mine water, Mine acids, Mine drainage, Water pollution sources, Water quality, Toxins, Chemical wastes, Gold, Uranium, South Africa, Slime

The heavy metal content of acid mine drainage from gold and uranium recovery in South Africa is examined. Enormous volumes of brackish saline fossil water as well as mining effluents are chiefly disposed of by pumping them to evaporation dams or slimes retention dams. The high salinity of the underground water corrodes mining gear and also has a severe ecological impact. During two periods of sampling, 17 sediment and 14 corresponding water samples were collected to determine critical sites of heavy metal enrichment. In situ acid leaching of slimes residues occurred from tailings areas along the gold/uranium mining periphery of the Witwatersrand Basin. Results from the Orange Free State goldfield also imply that the mining industry is suffering economic losses due to valuable and recoverable metal being discharged to the environment. Standards must be set for toxic metals without them: lead, cadmium, and mercury. In setting criteria for assessing water quality, special importance must be attached to those elements which are both very toxic and relatively accessible because of their biological impact. These elements include the nonmetals arsenic and selenium and the heavy metals mercury, cadmium, and lead. (Schaefer-IPA)
W79-08525

DESIGN FOR PRETREATMENT - LAND APPLICATION OF INDUSTRIAL WASTES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W79-08526

ESTUARINE PROCESSES, VOLUME I AND II.
For primary bibliographic entry see Field 2L.
W79-08543

APPLICATIONS OF A STEADY-STATE, ONE-DIMENSIONAL WATER QUALITY MODEL,
Rutgers-The State Univ., Piscataway, NJ. Dept. of Chemical and Biochemical Engineering.
J. S. Wu, and R. C. Ahlert.
Water Resources Bulletin, Vol. 15, No. 3, p 660-670, June 1979. 3 fig, 2 tab, 4 ref.

Descriptors: *Water quality, *Storm runoff, *Rivers, *Model studies, Mathematical models, Biochemical oxygen demand, Nitrogen, Ammonia, Dissolved oxygen, Anaerobic conditions, Steady flow, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Scouring, Sediments, Suspended solids, Streamflow.

A steady-state, one-dimensional water quality model has been formulated to evaluate spatial variations of biochemical oxygen demand, ammonia nitrogen, and dissolved oxygen for nontidal, branched river systems, with point sources of treated wastes and uniform nonpoint-source loads, under aerobic and/or anaerobic stream conditions. For anaerobic conditions, the decay rate of organic matter was assumed to be limited by the rate of oxygen addition to the streams via stream reaeration and net algal photosynthesis and respiration contributions. The model is applicable to stream impact analysis under sustained wet weather conditions, during which storm-runoff loads are generated by storms of sufficiently long duration to approach steady state in the river system. (Sims-ISWS)
W79-08562

WATER QUALITY IN MOUNTAIN RECREATIONAL AREAS,
California Univ., Los Angeles, Office of Environmental Science and Engineering.
R. L. Perrine, and R. A. Mah.
Water Resources Bulletin, Vol. 15, No. 3, p 612-627, June 1979. 5 fig, 4 tab, 31 ref. NSF GZ2269.

Descriptors: *Water quality, *Recreation, *Water pollution sources, *California, Forests, Forest watersheds, Recreation wastes, Pollutants, Mountains, Streams, Lakes, Nutrients, Bacteria, Coliforms, Benthos, Chemicals, Dissolved oxygen, Dissolved solids, Water temperature, Water pollution, Land use, *Sierra Nevada, *Owens River, *Inyo National Forest(CA), *Bishop Creek(CA).

Several seasons of water quality study in the eastern Sierra Nevada have provided much useful information. One study element focused in detail on a representative drainage: Bishop Creek, from sampled locations at 12,800 feet to the Owens River at 4,000 feet. Substudies ranged from geohydrology, through chemical and bacterial quality, to benthic ecology. A coordinated study also was made of spatial patterns of use. A second element focused on non-point source monitoring the length of the Inyo National Forest. From physical, chemical, and bacterial standpoints, water quality was generally very good. Strains of pathogenic bacteria were confirmed, and substantial further work to establish the importance of their presence is needed. Recreational use survey results were analyzed to produce a methodology permitting management of the resource as needed. In addition, basic policy recommendations to easily minimize risk were developed. (Sims-ISWS)
W79-08580

THE QUESTION OF NITRIFICATION IN THE PASSAIC RIVER, NEW JERSEY: ANALYSIS OF HISTORICAL DATA AND EXPERIMENTAL INVESTIGATION,
Rutgers-The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W79-08582

WATER QUALITY GUIDELINES FOR ACID MINE DRAINAGE AND STRIP MINE AREAS IN IOWA,
Energy and Mineral Resources Research Inst., Ames, IA. Dept. of Animal Ecology.
T. P. Nesler, and R. W. Bachmann.
Available from the National Technical Information Service, Springfield, VA 22161 as IS-ICP-56, Price codes: A09 in paper copy, A01 in microfiche. Report, February 1977. 177 p, 10 fig, 15 tab, 243 ref, 2 append.

Descriptors: *Strip mines, *Water quality, *Acid mine water, *Water pollution sources, *Iowa, Water pollution, Water pollution effects, Strip mine wastes, Mine wastes, Mine acids, Coal mine wastes, Coal mines, Reviews, On-site investigations, Sampling, Chemical analysis, Chemicals, Pollutants, Erosion, Sediments, Water quality control, Water pollution control.

Extensive literature compilation and investigation of state-of-the-art reclamation in four states contiguous to Iowa were conducted to review (1) the impact of coal mining upon water quality, (2) the reclamation techniques utilized in countering the adverse effects of acid mine drainage, and (3) the problems encountered in water quality managemet of strip-mined lands. Field analyses in strip-mine areas of Iowa have demonstrated similar degradation of water quality due to acid mine drainage. Distributions of alkalinity, specific conductance, sulfate, and total iron in the streams with watersheds affected by mining were significantly different than those determined for the control streams, according to Chi-square analysis. The water quality reflected by the results is expected to worsen with expanding coal-mining activity in Iowa unless effective reclamation accompanies this expansion. From the literature and experience base of other coal-mining states, certain techniques are considered essential in maintaining a suitable water quality in strip-mine areas. Segregation of acidic and nonacidic cast overburden, isolation and deep burial of spoil and mine wastes, hydrologic isolation of mine and coal processing areas, landscape stabilization through grading and revegetation, and cover or neutralization of abandoned strip-mine areas are the primary elements of successful regional reclamation and rehabilitation efforts. These efforts may be aided by adequate premining analysis of mining impacts and planning of reclamation activity suitable to land use potential. (Sims-ISWS)
W79-08611

A VERIFICATION OF THE QUAL-I WATER QUALITY MODEL FOR THE LOWER MISSISSIPPI RIVER,
Texas Univ. at Arlington. Dept. of Computer Science and Engineering.
T. M. Sparr.
Water Resources Bulletin, Vol. 15, No. 3, p 853-860, June 1979. 7 fig, 7 ref.

Descriptors: *Water quality, *Mississippi River, *Model studies, Mathematical models, Dye releases, Dispersion, Diffusion, Pollutants, Path of pollutants, Water pollution, Rivers, Analytical techniques.

This paper described the verification of the QUAL-I mass transport model for the lower Mississippi River between St. Francisville and Point a la Hache using dye studies conducted by the U.S. Geological Survey. QUAL-I is a one-dimensional, steady-state model for rivers and is capable of predicting longitudinal profiles of soluble materials entering rivers from point sources. Both conservative and nonconservative parameters of water quality can be considered. The major problems surmounted were the determination of a diffusion coefficient and the use of transient data to verify a steady-state model. (Sims-ISWS)
W79-08616

RATE OF AVAILABILITY OF TOTAL PHOSPHORUS IN RIVER WATERS,
West Virginia Univ., Morgantown. Dept. of Chemical Engineering.
F. H. Vehoff, and M. R. Heffner.
Environmental Science and Technology, Vol. 13, No. 7, p 844-849, July 1979. 2 fig, 5 tab, 15 ref.

Descriptors: *Phosphorus, *Rivers, *Lake Erie, *Great Lakes, *Algae, Sampling, Chemicals, Nitrates, Nitrites, Dissolved oxygen, Hydrogen ion concentration, Suspended solids, Harvesting of algae, Water pollution, Water pollution sources, Pollutants.

During storm events, large quantities of total phosphorus (dissolved, particulate, and adsorbed) are transported into Lake Erie from its tributaries. The effect of this phosphorus on the lake ecosystem depends upon the availability of this phosphorus for biological growth. In this paper, a variation of the algal assay procedure bottle test was used to determine the conversion rate of total phosphorus to an available form. The rate of conversion measured using indigenous microorganisms was less than 0.40% per day. This rate compared favorably with other experimental and theoretical information in the literature. (Sims-ISWS)
W79-08626

LEACHING ASPECTS OF OIL SLUDGE BIODEGRADATION IN SOIL,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Biochemistry and Microbiology.
For primary bibliographic entry see Field 5E.
W79-08629

ADVANCES IN GROUNDWATER HYDROLOGY.
For primary bibliographic entry see Field 2F.
W79-08631

NUMERICAL SIMULATION OF CONTAMINANT TRANSPORT IN SUBSURFACE SYSTEMS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
M. A. Marino.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 113-129, September 1976. 5 fig, 34 ref.

Descriptors: *Groundwater movement, *Wastes, *Simulation analysis, *Model studies, Mathematical models, Numerical analysis, Recharge, Flow, Equations, Aquifers, Analytical techniques, Finite element analysis, Dispersion, Groundwater, Aquifer systems, Water levels, Water table, Pollutants, Spatial distribution, Surface-groundwater relationships.

This paper investigated the effects of possibly contaminated recharge effluent on the quality and quantity of groundwater supplies. Emphasis was given to the possible contamination of groundwater in the region beneath and in the proximity of the recharge site. The pollutants of concern are conservative substances, i.e., dissolved chemical substances which remain unaltered during the transport process. Numerical simulation of contaminant transport in subsurface systems involves the simultaneous or sequential solution of the flow and mass transport equations subject to appropriate initial and boundary conditions. Both finite difference and finite element techniques have been used to solve these equations. A two-dimensional finite element model was presented that simulates the movement and depth distribution of a dissolved chemical substance in a recharged stream-aquifer system. Numerical examples that illustrate the applicability of the model were presented. (See also W79-08631) (Humphreys-ISWS)
W79-08641

THE FINITE ELEMENT METHOD IN GROUNDWATER TRANSPORT,
Princeton Univ., NJ. Dept. of Civil Engineering.
W. G. Gray.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 130-143, September 1976. 46 ref.

Descriptors: *Groundwater movement, *Mathematical models, *Finite element analysis, *Reviews, Water pollution, Model studies, Analytical techniques, Dispersion, Convection, Equations, Groundwater.

This paper was a literature review of the use of the finite element method in modeling contaminant transport in groundwater. Alternative formulations of the procedure, analyses of the behavior of finite element solutions, and various field applications were discussed. Further research is needed to improve the efficiency of existing schemes and to further reduce the dissipative and dispersive errors generated. (See also W79-08631) (Humphreys-ISWS)
W79-08642

CHEMICAL ASPECTS OF PRESENT AND FUTURE HYDROGEOLOGIC PROBLEMS,
Geological Survey, Reston, VA. Water Resources Div.; and Waterloo Univ. (Ontario).
W. Back, and J. A. Cherry.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 153-172, September 1976. 1 fig, 123 ref.

Descriptors: *Geochemistry, *Water quality, *Ion exchange, *Mass transfer, *Water temperature, Ion transport, Groundwater movement, Organic compounds, Aquitards, Path of pollutants, Reviews.

Low temperature aqueous geochemistry has made significant contributions to the understanding of groundwater systems during the past 20 years primarily by use of the law of mass action, mass balance relationships, and isotopes. Hydrologic and groundwater quality problems associated with social and economic issues demand an expanded effort in application of principles of geochemistry. These efforts require a geochemical evaluation of the transfer term in the transport equation in order to construct predictive models for natural and contaminated systems. This additional understanding will be gained by expanding our efforts to include aquitards and the unsaturated zone rather than the almost exclusive focus on aquifers and the saturated zone that has been so common in the past, by incorporating principles from other disciplines, and by changing scale in both time and space. Along the path leading towards the development of useful predictive transport models for nonconservative constituents, there loom many problems, including the acquisition of adequate data on geology, chemical mechanisms and kinetics, bacteria, organic compounds, and the transferability of data between laboratory and field systems. A review of the recent literature indicates that work has begun on many of these problems. (See also W79-08631) (Woodard-USGS)
W79-08644

DISPERSION IN NON-UNIFORM AND ANISOTROPIC POROUS MEDIA,
Shell Development Co., Houston, TX.
For primary bibliographic entry see Field 2F.
W79-08645

IDENTIFICATION OF GEOCHEMICAL PATTERNS IN GROUNDWATER BY NUMERICAL ANALYSIS,
Suwannee River Water Management District, White Springs, FL.
F. W. Lawrence, and S. B. Upchurch.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 199-214, September 1976. 7 fig, 3 tab, 18 ref.

Descriptors: *Water quality, *Hydrogeology, *Groundwater, *Florida, Numerical analysis, On-site investigations, Analytical techniques, Calcium, Hardness(Water), Alkalinity, Silica, Magnesium, Fluorides, Phosphorus, Sampling, Chemical properties, Aquifers, Variability, Water wells, Water properties, *Floridan aquifer, Hydrochemical model.

A total of 152 water wells, completed at similar horizons in the upper Floridan Aquifer, in a four township area around Lake City, Florida, were analyzed for 15 chemical variables. R-mode factor analysis was used to identify those variables that reflect areally significant recharge processes. Of the 15 variables, 9 convey significant information and cluster into 3 groups. Factor 1, which includes calcium, hardness, alkalinity and specific conductivity, reflects waters that have been in contact with the limestones and dolomites of the Floridan Aquifer for the longest period and approach equilibration with those strata. Factor 2, which includes silica, magnesium, and fluoride, represents recharge waters percolating through the clastics overlying the Floridan. Factor 3, which includes only phosphorus, represents recharge water derived by direct connection with the surface in the area of sinkhole lakes. This study showed that factor analysis is useful in interpreting raw chemical data and in relating those data to specific hydrogeologic processes. Practical applications of this technique include water use and water resource management. Uses for the technique include: (1) determining the real or predicted extent and degree of contamination from recharge events, (2) identifying areas where water quality may limit water use, (3) delineating areas where activities such as land disposal of wastes, artificial recharge and excessive pumping may have an impact on water quality or quantity, and (4) identifying zones of potentially higher well yields. (See also W79-08631) (Humphreys-ISWS)
W79-08647

MIGRATION OF LANDFILL LEACHATE THROUGH UNCONSOLIDATED POROUS MEDIA,
Illinois State Geological Survey, Urbana.
K. Cartwright, R. A. Griffin, and R. H. Gilkeson.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 215-227, September 1976. 4 fig, 3 tab, 13 ref. EPA 68-03-0211.

Descriptors: *Landfills, *Leachate, *Groundwater, *Water pollution sources, *Illinois, On-site investigations, Laboratory tests, Sampling, Movement, Analysis, Heavy metals, Porous media, Flow, Pollutants, Hydraulic conductivity, Percolation, Attenuation, Chlorides, Sodium, Potassium, Lead, Cadmium, Water properties, *DuPage County(IL).

Leachate was collected by anaerobic techniques from the 15-year-old DuPage County sanitary landfill near Chicago, Illinois, and passed through 44 laboratory columns that contained various mixtures of calcium-saturated clays and washed quartz sand. The columns were constructed to simulate slow, saturated anaerobic flow, and manometers were placed at 5 locations in each column to measure any hydraulic conductivity changes. Leachates were run through the columns for periods of up to 10 months, during which time effluents were periodically collected and analyzed for 21 chemical constituents. Chloride and certain organics were relatively unattenuated by passage through the clay columns; monovalent cations, such as Na, K, and NH4, were moderately attenuated; and heavy metals, such as Pb, Cd, and Zn, were attenuated by even small amounts of clay. Concentrations of Ca and Fe in the column effluents increased markedly over the original refuse leachate concentrations as a result of cation exchange and from a reduction of the oxidized Fe on clay surfaces. Both biologically active and sterilized leachate reduced the hydraulic conductivity during the experiment. The active leachate reduced the hydraulic conductivity to a much greater degree than the sterile leachate. Results of the laboratory data were checked at the DuPage County sanitary landfill and other existing landfills where detailed field data are available. These field data showed a 'hardness halo' corresponding to the Ca release in the columns. The relative attenuation rates of some of the ions were also confirmed by the field data. The change in hydraulic conductivity was not as clearly shown. (See also W79-08631) (Humphreys-ISWS)
W79-08648

THEORETICAL DEVELOPMENTS AND PRACTICAL NEEDS IN THE FIELD OF SALT WATER INTRUSION,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
A-A. I. Kashef.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 228-242, September 1976. 10 ref.

Descriptors: *Aquifers, *Saline water intrusion, *Water management(Applied), *Reviews, Coasts, Dispersion, Diffusion, Porous media, Analytical techniques, Groundwater, Control, Saline water-freshwater interfaces, Mathematical models, Hydraulic models, Saline water barriers, Coastal aquifers.

During the last two decades, extensive work in the field of salt water intrusion in coastal aquifers has been done. Most of the well-established theories treated the location of the salt-freshwater interface assuming immiscible fluids. Extensive theoretical developments in the analysis of dispersion have been made recently, but not as yet to the satisfaction of the water resources managers who are seeking practical guidelines for the control of salt water intrusion. The urgent needs for water supply in some areas dictated the application of costly trial and error control methods. An attempt was made in this paper to review the advances in the theoretical developments in order to pinpoint the practical needs in this field. (See also W79-08631) (Humphreys-ISWS)
W79-08649

DETERMINATION OF PENTACHLOROPHENOL IN MARINE BIOTA AND SEA WATER BY GAS-LIQUID CHROMATOGRAPHY AND HIGH-PRESSURE LIQUID CHROMATOGRAPHY,
Environmental Research Services, Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W79-08664

THE WEST FALMOUTH OIL SPILL: HYDROCARBONS IN THE SALT MARSH ECOSYSTEM,
Victoria Ministry for Conservation, Melbourne

(Australia).
For primary bibliographic entry see Field 5A.
W79-08666

CHANGES IN THE PHYTOPLANKTON OF AN ENGLISH LAKE, 1945-1977,
Freshwater Biological Association Ambleside (England).
J. W. G. Lund.
Hydrobiological Journal, Vol. 14, p 6-21, 1978. 9 fig, 5 tab, 23 ref.

Descriptors: *Phytoplankton, *Sewage, England, *English Lake District, Water quality, Nutrients, *Eutrophication, Algae, Laboratory tests, On-site-investigations, Phosphorous compounds, Silicants, Nitrogen, *Blelham Tarn, Agricultural chemicals, Agricultural runoff.

The phytoplankton of a small lake in the English Lake District has been sampled and the lake water analyzed on a weekly basis since 1945. Changes in the amount and nature of the sewage entering it and improvements in farming have led to increased algal abundance. The phytoplankton now contains several new species characteristics of eutrophic lakes, none of which was seen before 1954. Observation and analysis have been combined with a variety of experiments designed to elucidate the main factors determine these quantitative and qualitative changes. They also suggest possible future algal changes if eutrophication continues. Some examples are given with special reference to the use of large enclosures in the lake. These enclosures permit experiments on natural populations. The major nutrient limiting algal growth is phosphorus. Silicon and organic complexes, notably with iron, are also important. Nitrogen was of minor importance until recently, presumably because the increased supply of phosphorus, and consequent larger algal populations have led to greater demands for nitrogen. (Katz-EIS)
W79-08668

AIR-POWERED STREAM TANK FOR LABORATORY USE,
Toronto Univ., (Ontario). Div. of Life Sciences.
D. D. Williams.
The Progressive Fish-Culturist, Vol. 41, No. 2, p 88-89, 1979. 2 fig, 1 ref.

Descriptors: *Research equipment, *Aquaria, Methodology, Laboratory equipment, Bioassay, Equipment, Analytical techniques, Currents(Water), Streamflow, Laboratory tests, Aquiculture, Aquatic insects, Benthos.

Small laboratory stream tanks are commonly used in bioassay work and behavioral studies, and as culturing and holding facilities for fishes and invertebrates. This paper presents the details of a stream-tank system and the apparatus devised to power it with compressed air. The apparatus consists of a double-walled stream tank with an attached paddle wheel. The variable-speed paddle wheel is driven by compressed air, an advantage over electric motors in terms of cost. The tank has been used successfully to study the effects of silt on various species of aquatic insects and macrocrustaceans. (Deal-EIS)
W79-08669

LEAD ACCUMULATION IN AQUATIC PLANTS FROM METALLIC SOURCES INCLUDING SHOT,
Montana Univ., MO. Dept. of Botany.
For primary bibliographic entry see Field 5A.
W79-08670

EXPERIMENTAL INTENSIVE CULTURE OF TIGER MUSKELLUNGE IN A WATER REUSE SYSTEM,
Michigan Dept. of Natural Resources, Mattawan. Wolf Lake State Fish Hatchery.
For primary bibliographic entry see Field 5A.
W79-08672

DETERMINATION OF TRACE ELEMENTS IN MARINE ORGANISMS-II RELATIONSHIP BETWEEN THE BODY SIZE OF SARGASSUM HORNERI AND CONCENTRATION OF IRON (IN JAPANESE),
National Inst. of Radiological Sciences, Nakaminato (Japan). Marine Radio-Ecological Research Station.
For primary bibliographic entry see Field 5A.
W79-08673

HEAVY METAL CONTENTS IN DEEP-SEA FISHES (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan). Lab. of Food Hygienic Chemistry.
For primary bibliographic entry see Field 5A.
W79-08674

SUCCESSION OF AQUATIC INSECTS CAUSED BY MILD ORGANIC POLLUTION IN RIVERS (IN JAPANESE),
Freshwater Fisheries Lab., Tokyo (Japan).
For primary bibliographic entry see Field 5C.
W79-08679

DETERMINATION OF TOTAL ORGANIC NITROGEN AND ORGANO-METALLIC NICKEL IN OIL, SEDIMENTS AND MARINE PRODUCTS,
Osaka Prefecture Inst. of Public Health (Japan). Lab. of Food Chemistry.
For primary bibliographic entry see Field 5A.
W79-08681

COMPARATIVE STUDY OF 85SR AND 90SR CONCENTRATION AND ELIMINATION IN CARASSIUS AURATUS GIBELIO,
Department of Radiobiology, Bucharest (Romania).
For primary bibliographic entry see Field 5A.
W79-08682

PESTICIDE AND PCB OF COMMON EIDER, HERRING GULL AND GREAT BLACK-BACKED GULL EGGS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
R. C. Szaro, N. C. Coon, and E. Kolbe.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 394-399, 1979. 2 tab, 17 ref.

Descriptors: *Pesticide residues, *Polychlorinated biphenyls, *Bird eggs, *Tissue analysis, *Bioaccumulation, *Kepone, DDT, DDE, DDD, Dieldrin, Heptachlor, Chlorinated hydrocarbon pesticides, Gulls, Common Eider duck, Path of pollutants, Maine, Virginia.

The eggs of Herring Gull, Black-backed Gull, and Common Eider from Maine and Herring Gull from Virginia were analyzed for pesticide and PCB residues. All but one Common Eider egg contained detectable residues of DDE. PCBs were detected in all eggs. Levels of both DDE and PCBs were low. No other organochlorine compounds were detected. There were no significant differences in the residue levels of DDT and its metabolites or PCBs in the Herring Gull eggs collected in Maine and Virginia. However, all were significantly greater than the residues in Common Eider eggs. The six Herring Gull eggs from Virginia did not contain detectable levels of Kepone. Great Black-backed Gull eggs contained significantly more DDE and PCBs than Herring Gull eggs from either Maine or Virginia. In additions, low levels of several other pesticides were detected in Great Black-backed Gull eggs. (Deal-EIS)
W79-08683

HUMAN WASTE DISPOSAL ON BEACHES OF THE COLORADO RIVER IN GRAND CANYON,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 5D.
W79-08722

MOVEMENT OF SELECTED METALS, ASBESTOS, AND CYANIDE IN SOILS: APPLICATIONS TO WASTE DISPOSAL PROBLEMS,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
W. H. Fuller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 905, Price codes: A12 in paper copy, A01 in microfiche. Report EPA-600/2-77-020, 1977. 242 p, 40 fig, 43 tab, 330 ref, 2 append.

Descriptors: *Waste disposal, *Leachate, *Soil mechanics, *Landfills, *Heavy metals, Asbestos, Arsenic compounds, Design criteria, Movement, Migration, Municipal wastes.

The movement of certain hazardous substances in soils at land disposal sites is discussed. The selected hazardous materials investigated included wastes containing arsenic, asbestos, beryllium, cadmium, chromium, copper, cyanide, iron, lead, mercury, selenium, and zinc. Data on hazardous material movement in soils was obtained from previous literature and from laboratory studies of municipal landfill leachate movement. Soil and waste considerations in the selection and management of disposal sites for minimum movement of hazardous materials are reviewed and data on soils, geological materials, and the chemistry of selected hazardous materials relevant to their migration in soils is included. The properties of mixtures of hazardous materials and the effects of high concentrations of other organic and inorganic solutes on the wastes are discussed. (Lisk-FRC)
W79-08746

INACTIVATION OF ENTERIC BACTERIA AND VIRUSES IN SANITARY LANDFILL LEACHATE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
R. S. Engelbrecht, and P. Amirhor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 973, Price codes: A06 in paper copy, A01 in microfiche. Report, 1975. 114 p, 29 fig, 23 tab, 41 ref.

Descriptors: *Leachate, Landfills, *Viruses, *Salmonella, *Streptococcus, Disinfection, Filtration, Reverse osmosis, Iron, Zinc, Municipal wastes.

The effect of sanitary landfill leachate on the survival of pathogens in landfills and leachate and the operational or environmental conditions influencing the inactivation of the bacteria and viruses were studied. Leachate samples were collected from a test lysimeter and from two landfill sites and the chemical and physical properties were characterized. The test pathogens, Salmonella typhimurium, a fecal streptococcus, poliovirus type 1, and echovirus type 7 were added to the different leachate samples and the inactivation capacity of each was evaluated. Leachate had a significant impact on the inactivation of the pathogens and the inactivation capacity was influenced by the pH and temperature conditions. At pH 5.4, the inactivation capacity was greater than at pH 7.0 and continued to increase with increasing temperature. The inactivation capacity was affected by dilution of the leachate and the age of the landfill material. No correlation between the chemical and biological characteristics of the leachate was observed. Ultrafiltration techniques were used to fractionate the leachate to analyze the inactivation properties. The inactivation properties associated with the leachate were found to be in the 500 molecular weight permeate and in high concentrations of free metals such as iron and zinc or short chain fatty acids. Further fractionation of the leachate was performed with reverse osmosis. (Lisk-FRC)
W79-08747

WASTE MANAGEMENT OPERATIONS, SAVANNAH RIVER PLANT, AIKEN, SOUTH CAROLINA.
Department of Energy, Washington, DC.
Final Environmental Impact Statement Report ERDA-1537, 1977. 693 p, 94 fig, 109 tab, 12 append.

Group 5B—Sources Of Pollution

Descriptors: *Environmental effects, *Radioactive wastes disposal, *Leachate, *Nuclear wastes, *Public health, Liquid wastes, Solid wastes, Water pollution sources, Industrial wastes, Waste disposal, Environmental Impact Statement.

A detailed analysis is provided of the actual and potential environmental effects associated with waste management operations at the Savannah River Plant, a nuclear material production facility. The management of radioactive and non-radioactive gas, liquid, solid, and thermal wastes is considered. The effects of waste storage are explored. The effects of effluents from normal operations are discussed as well as the potential effects of abnormal operations of waste storage and handling facilities. Unavoidable effects are discussed, and alternative waste management practices are described. These alternatives include: No additional radioactive storage on-site; No additional waste storage and restoration of waste management areas; Continuation of present waste management practices; and Continuation of existing operation with improved waste management practices consistent with ERDA policies and standards. A cost-benefit analysis of the alternatives is presented. (Small-FRC)
W79-08780

5C. Effects Of Pollution

ENDOSULFAN POLLUTION OF RIVERS AND STREAMS IN THE LOSKOP DAM COTTON-GROWING AREA,
Plant Protection Research Inst., Pretoria (South Africa).
L. P. Van Dyk, and C. G. Greeff.
Agrochemophysica, Vol. 9, No. 3, p 71-76, 1977. 1 fig, 8 tab, 12 ref.

Descriptors: *Endosulfan, *Water pollution, *Pesticide residues, Loskop Dam, Rivers, Cotton, Aquatic animals, Fish, Invertebrates, Streams, Pollutants, Toxicity, Water pollution sources, Fertility, Aquatic populations.

The occurrence of endosulfan in a heavily treated area was investigated to determine the effect of residues on the aquatic fauna. Residues in water and population counts of aquatic fauna were monitored in the Loskop Dam irrigation area. Acute toxicity tests, and growth, fertility, behavior, and short term high concentration pollution studies were conducted. Endosulfan was present in 4% of the samples collected; all endosulfan pollution occurred in the downstream part of the irrigation area. Rapid fluctuations in the aquatic fauna pollution were apparently mainly due to changes in the habitats and probably not due to endosulfan residues. Endosulfan was shown to be very toxic to fish. Growth of fish was not influenced by sublethal endosulfan concentrations; due to accidental introduction of predators to the fish fertility experiments, effects of endosulfan on fertility could not be determined. Invertebrate aquatic fauna were not affected by sublethal endosulfan concentrations. Low concentrations of endosulfan stimulated activity in Sarotherodon mossambicus; at higher concentrations stimulation decreased. (Schaefer-IPA)
W79-08502

HEALTH HAZARDS OF SOUTH AFRICAN MINE WATER,
Gold Fields of South Africa Ltd., Johannesburg.
P. Smit.
Journal of the South African Institute of Mining and Metallurgy, Vol. 77, No. 9, p 193-197, April 1977. 3 fig, 5 tab.

Descriptors: *Public health, *Potable water, *Mine water, Mine drainage, Water pollution sources, Water quality, Hazards, Diseases, Human diseases, Sanitary engineering, Water pollution effects, Cholera, Dysentary, Typhoid, Environmental sanitation, Water purification, Epidemics.

The health hazards associated with potable water in South African mines is examined. Most mines have dual water supplies: potable water for human consumption and fissure water for industrial use. The hazards of a single system for both types of water are considerable because of the even-present possibility of interconnection. Water-purification plants on the mine surface that are associated with water-cooling towers may be the best way to provide cheap, safe industrial water. The principal enteric, bacterial, and parasitic diseases transmitted by mine water are cholera, typhoid, paratyphoid fever, bacillary and amoebic dysentary, and roundworms. As recently as 1973-74, epidemics of typhoid occurred in mines. Dysentary occurs excessively, and as long as it does, typhoid cases can be expected. A survey showed 2.94 per 1000 workers in African gold mines were chronic typhoid carriers. The only cholera epidemic in South Africa occurred in a mine in 1974; as in the case of typhoid and dysentary, water was the vehicle of transmission. Causes of the water pollution are discussed. Underground latrine areas are not properly maintained and often show contamination. A second source of contamination of mine water is body sweat. (Schaefer-IPA)
W79-08516

POWER PLANT ENTRAINMENT, A BIOLOGICAL ASSESSMENT.
Academic Press, Inc., New York, New York, 1978. 271 p. Schubel, J. R., and Marcy, B. C., Jr., (Eds.).

Descriptors: *Environmental effects, *Entrainment, *Powerplants, Thermal stress, Mortality, Aquatic life, Reviews, Workshop.

This book is the report of a workshop sponsored by The Ad Hoc Committee on Entrainment. The Workshop was held January 17-21 and March 20-22, 1977 at the Marine Sciences Research Center, Stony Brook, New York. The primary goals of the workshop were to assess the effects of stresses associated with entrainment (thermal, physical, and chemical); to develop guidelines for conceptual design and operation of power plants with once-through cooling systems to minimize the mortality of organisms associated with entrainment stresses; and to outline research priorities. The book contains seven chapters written by different authors plus an appendix and a glossary. (See W79-08528 thru W79-08534) (Chilton-ORNL)
W79-08527

INTRODUCTION.
In: Power Plant Entrainment, A Biological Assessment, Chapter 1, p 1-18, 1978. 3 fig, 3 tab, 12 ref.

Descriptors: *Reviews, *Environmental effects, *Entrainment, Powerplants.

This chapter was composed by the Ad Hoc Committee on Entrainment and sets forth an overview of the problems of entrainment. Included in the chapter are discussions of characteristics of steam electric plants, definition of entrainment, perceived effects of entrainment and adoption of thermal criteria and standards, explanation of the laws concerning entrainment, an assessment of the significance of entrainment losses and a summary of the goals of the workshop report. (See also W79-08527) (Chilton-ORNL)
W79-08528

THERMAL EFFECTS OF ENTRAINMENT,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, C. C. Coutant, and P. M. J. Woodhead.
In: Power Plant Entrainment, A Biological Assessment, Chapter 2, p 19-93, 1978. 13 fig, 9 tab, 97 ref.

Descriptors: *Environmental effects, *Entrainment, *Thermal stress, Powerplants, Mortality, Aquatic life.

This chapter presents a description of the range of time-excess temperature histories typical of operating and proposed steam electric stations; describes a conceptual framework for predicting thermal effects on organisms entrained by powerplants with once-through cooling systems; reviews the literature on thermal tolerances of a variety of aquatic organisms; assesses the usefulness of field studies of entrainment in estimating thermally-induced mortalities; outlines the types of studies needed for an improvement in prediction and assessment of the thermal effects of entrainment; and specifies design and operating criteria for power plants with once-through cooling systems to minimize entrainment losses caused by thermal stress. (See also W79-08527) (Chilton-ORNL)
W79-08529

BIOCIDES,
Maryland Univ., Solomons. Chesapeake Biological Lab.
R. P. Morgan, II, and E. J. Carpenter.
In: Power Plant Entrainment, A Biological Assessment, Chapter 3, p 95-134, 1978. 6 fig, 3 tab, 79 ref.

Descriptors: *Environmental effects, *Chlorination, Powerplants, Cooling water, Aquatic life, Reviews.

This chapter presents an overview of the use of chlorine as a biocide in cooling water of powerplants. The effects of chlorination on various forms of aquatic life (phytoplankton, invertebrates and fish) are discussed in some detail. It is noted that, while the chemistry of chlorine in uncontaminated freshwater is simple, in estuarine and marine systems it is complex due to the inherent chemical composition of these waters. Recommendations regarding chlorination processes in power plants include the use of intermittent, low level chlorination as the preferred technique. During periods of limited growth of fouling organisms, cessation of chlorination and the use of mechanical scrubbing systems is recommended. For cooling tower systems, it is recommended that blowdown products not be released into the receiving waters, but be placed into a receiving pond prior to release into the receiving waters. (See also W79-08527) (Chilton-ORNL)
W79-08530

EFFECTS AND IMPACTS OF PHYSICAL STRESS ON ENTRAINED ORGANISMS,
NUS Corp., Pittsburgh, PA. Ecological Sciences Div.
B. C. Marcy, Jr., A. D. Beck, and R. E. Ulanowicz.
In: Power Plant Entrainment, A Biological Assessment, Chapter 4, p 135-188, 1978. 4 fig, 2 tab, 98 ref.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Aquatic life, Stress, Mortality, Physical stress.

Physical damage, principally occurring in passage through the pumps during entrainment, is identified as the major cause of mortality during the normal operational cycle of the power plant. Available data indicate that mortality is at least partially related to size and life stage of individual organisms, tolerance of the individual species and life stage, and differences in power plant cooling system designs and operational characteristics. It is suggested that the impact of power plants can be minimized by siting in nonproductive areas and by utilizing closed cooling systems. (See also W79-08527) (Chilton-ORNL)
W79-08531

CUMULATIVE EFFECTS, A FIELD ASSESSMENT,
A. D. Beck.
In: Power Plant Entrainment, A Biological Assessment, Chapter 5, p 189-210, 1978. 1 tab, 16 ref.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Aquatic life, Thermal stress, Chlorination, Mortality, Physical stress.

Results of field studies at 14 power plants with once-through cooling systems are summarized in tabular form. In those cases where mortality of entrained ichthyoplankton and juvenile fishes has been apportioned among the several kinds of stresses (thermal, chemical, and physical), physical

stresses usually dominate. Data indicated that the relative importance of chlorination in causing mortality of zooplankton may be greater than for larval and juvenile fishes. (See also W79-08527) (Chilton-ORNL)
W79-08532

ON SELECTING THE EXCESS TEMPERATURE TO MINIMIZE THE ENTRAINMENT MORTALITY RATE.
In: Power Plant Entrainment, A Biological Assessment, Chapter 6, p 211-227, 1978. 10 fig, 1 tab.

Descriptors: *Environmental effects, *Entrainment, Aquatic life, Mortality, Temperature, Thermal stress, Stress, Chemical stress, Physical stress.

This chapter deals with the fundamental concept that the optimum excess temperature at which to operate a power plant cooling system must include consideration of thermal, chemical and physical stresses rather than thermal stresses alone. Emphasis is placed on the rule that operation of a power plant cooling system at a small excess temperature can be more harmful than operation at a larger excess temperature. (See also W79-08527) (Chilton-ORNL)
W79-08533

CONCLUSIONS AND RECOMMENDATIONS.
In: Power Plant Entrainment, A Biological Assessment, Chapter 7, p 229-242, 1978. 3 ref.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Aquatic life, Research and development.

In this chapter by the Ad Hoc Committee on Entrainment it was concluded that the minimizing of entrainment mortality can be accomplished by careful site selection as well as plant design and operating criteria. The use of closed-cycle cooling systems is recommended. Research priorities which are recommended include the development of thermal resistance curves for a variety of organisms, study of time-excess temperature histories, laboratory verification of predicted mortalities, studies on sublethal effects of acute thermal shock, research into the chemistry of chlorine and ozone in natural waters, tolerance studies, studies on behavioral responses of a variety of organisms, studies on accumulation and biomagnification of chlorination products and effects of physical stresses. (See also W79-08527) (Chilton-ORNL)
W79-08534

METABOLIC RESPONSE TO THERMAL CHANGES OF THE ADULT FIDDLER CRAB, UCA PUGILATOR, AND THE EFFECT OF PCB'S,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
F. J. Vernberg, M. S. Guram, and A. M. Savory.
Marine Biology, Vol. 48, No. 2, p 135-141, 1978. 8 tab, 9 ref.

Descriptors: *Environmental effects, *Temperature, Thermal stress, Crabs, Metabolism, Respiration, Polychlorinated biphenyls.

Aroclors 1016 and 1254 did not appear to influence the respiratory response pattern of cold- or warm-acclimated crabs over the thermal range of 10 to 30C. Metabolic measurements made at one acclimation temperature showed that these Aroclors did effect respiration rates in a unpredictable manner: at 15C no consistent effect was seen for males but the metabolic rate was reduced in females; at 25C the rates were increased for males but the metabolic rate was reduced in females; at 25C the rates were increased in both sexes; and at 35C a tendency towards metabolic inhibition was observed in both sexes. (Chilton-ORNL)
W79-08535

AGONISTIC BEHAVIOR IN CRAYFISH IN RELATION TO TEMPERATURE AND REPRODUCTIVE PERIOD,
Savannah River Ecology Lab., Aiken, SC.
J. H. Thorp.
Oecologia, Vol. 36, No. 3, p 273-280, 1978. 1 fig, 2 tab, 22 ref.

Descriptors: *Environmental effects, *Temperature, Behavior, Seasonal, Reproduction.

Cambarus latimanus LeConte were acclimated for 2 wks at 9.5, 14, 22, and 30C in summer and at 9.5 and 22C in winter. Agonistic behavior of pairs of the same sex was recorded for 1 h following acclimation. Three experimental steps (acclimation, testing, and temperature-readjustment) were carried out with all crayfish pairs. Duration of total agonistic behavior, maximum duration of a single agonistic interaction, and average length of an agonistic encounter were all found to be inversely related to acclimation temperature. It was concluded that for ectothermic species whose agonistic behavior is closely associated with reproductive processes (including competition for mates) the level of agonism will vary, either directly or inversely, depending upon whether the reproductive period is cued by increasing or decreasing seasonal temperatures, respectively. (Chilton-ORNL)
W79-08536

STRUCTURE-TOXICITY CORRELATIONS OF ORGANIC CONTAMINANTS IN AQUEOUS COAL-CONVERSION EFFLUENTS,
Oak Ridge National Lab., TN; and Tennessee Univ., Oak Ridge. School of Biomedical Sciences.
T. W. Schultz, L. M. Kyte, and J. N. Dumont.
Archives of Environmental Contamination and Toxicology, Vol. 7, No. 4, p 457-463, 1978. 2 fig, 1 tab, 13 ref.

Descriptors: *Environmental effects, *Toxicity, Organic compounds, Protozoa, Effluents, Coals, Aquatic life, Coal-conversion effluents, Organic structure, Tetrahymena pyriformis.

This investigation examines possible correlations between the partition coefficients in octanol-water systems of a group of potential pollutants and the toxicity of these compounds to Tetrahymena pyriformis. It was found that, generally, an increase in alkyl substitution increases toxicity and decreases solubility. Compounds containing the equivalent of two or more methyl groups were found to be more toxic than those with one or no alkyl substitutions. (Chilton-ORNL)
W79-08537

FACTORS REGULATING THE REPRODUCTIVE CYCLES OF TWO NORTHEAST PACIFIC CHITONS, TONICELLA LINEATA AND T. INSIGNIS,
British Columbia Univ., Vancouver. Dept. of Zoology.
J. H. Himmelman.
Marine Biology, Vol. 50, p 215-225, 1979. 7 fig, 1 tab, 36 ref.

Descriptors: *Environmental effects, *Temperature, *Phytoplankton, Spawning, Reproduction, Seasonal, Chitons, Tonicella lineata, Tonicella insignis.

Results of this study show that the same reproductive pattern is exhibited by the two closely related chitons Tonicella lineata and T. insignis. There is a prolonged period of gonadal growth extending through the coldest part of the year, and an abrupt spawning at the time of the spring phytoplankton outburst. Various phases of annual temperature and photoperiod cycles appear to coincide with particular phases of gametogenesis and could act as external cues. While phytoplankton appears to be the major stimulus for spawning, there is some evidence that temperature may influence spawning. Temperature may inhibit spawning in T. lineata if conditions are unseasonably cold. (Chilton-ORNL)
W79-08538

GROWTH PATTERNS OF CODIUM FRAGILE SSP. TOMENTOSOIDES IN RESPONSE TO TEMPERATURE, IRRADIANCE, SALINITY, AND NITROGEN SOURCE,
Rhode Island Univ., Kingston. Dept. of Botany.
M. D. Hanisak.
Marine Biology, Vol. 50, No. 4, p 319-332, 1979. 12 fig, 8 tab, 40 ref.

Descriptors: *Environmental effects, *Algae, Growth rates, Reproduction, Temperature, Light, Salinity, Nitrogen, Seasonal, Codium fragile spp tomentosoides.

In this study on growth patterns, reproduction and productivity of Codium fragile it was found that maximal growth was more significantly correlated with temperature than with any other factor measured. Multiple correlation models suggested an interaction between temperature, irradiance and available nitrogen. Although growth and reproduction are confined to warmer months, this species of algae can survive severe winter conditions and initiate new growth in the spring. (Chilton-ORNL)
W79-08539

COMPARATIVE STUDIES ON THE METABOLISM OF SHALLOW-WATER AND DEEP-SEA MARINE FISHES. V. EFFECTS OF TEMPERATURE AND HYDROSTATIC PRESSURE ON OXYGEN CONSUMPTION IN THE MESOPELAGIC ZOARCID MELANOSTIGMA PAMMELAS,
California Univ., Los Angeles. Dept. of Biology.
B. W. Belman, and M. S. Gordon.
Marine Biology, Vol. 50, No. 3, p 275-281, 1979. 2 fig, 4 tab, 25 ref.

Descriptors: *Environmental effects, *Metabolism, Fish, Temperature, Hydrostatic pressure, Shallow water, Deep water, California, Melanostigma pammelas.

Measurements of routine oxygen consumption rates in Melanostigma pammelas were made over ecologically relavent ranges of 3 variables: temperature, 3 to 10 C; hydrostatic pressure, 1 to 170 atm; and oxygen partial pressure, 1 to 160 mm Hg. The most significant finding of the study was that within the ranges of temperatures, hydrostatic pressures and dissolved oxygen levels normally encountered by these fish in the basins off southern California, only temperature has a significant effect on routine rates of weight specific oxygen consumption. Q10's were 6.75 between 3 and 5 C, 1.47 between 5 and 7 C, and 17.4 between 7 and 10 C. (Chilton-ORNL)
W79-08540

ESTUARINE PROCESSES, VOLUME I AND II.
For primary bibliographic entry see Field 2L.
W79-08543

RIVER POLLUTION AND PEOPLE,
Water Research Center, London (England). Pollution B (Rivers) Div.
J. H. Garland.
Water, No. 25, p 46-48, March 1979. Presented at the conference 'Water Quality: The Implications of the Control of Pollution Act 1974; Part II.' 1 fig, 3 ref.

Descriptors: *Rivers, *Water pollution, *Water quality control, England, Wales, Water pollution control, Public health, Water quality, Urbanization, Water pollution effects, Water policy, Water quality standards, Effluents, Human population.

The relationship between river pollution and people is examined. The uses of rivers, in an ideal world, should be balanced such that the essential drainage function (a polluting process) does not oust the quality-sensitive in situ and abstractive uses. Effluent standards are needed to protect the water consumer from dangers of consumption of bacterially contaminated water, ingestion of substances tolerated by river biota but harmful to humans, and chronic ingestion of substances lethal to man in small quantities, water treatment, sewage treatment, and rejection of sources not complying with standards afford protection against these dangers. A simple equation relating population density and effluent consent standards to river water qual-

ity is detailed. The relationship between concentrations of biochemical oxygen demand (BOD) and inorganic nitrogen in rivers and catchment population densities at three standards for effluent treatment is graphed. The small proportion of polluted rivers in England and Wales probably occur because the population densities of their catchments are large, and their lack of treatment facilities, which is tolerated in less populous regions has a very detrimental effect on river water quality. Class III rivers should be redefined as those rivers capable of supporting coarse fish, but which are not required for public water supply. Urban rivers should not be reclaimed past the point where they would support coarse fish. (Schaefer-IPA)
W79-08590

WATER QUALITY GUIDELINES FOR ACID MINE DRAINAGE AND STRIP MINE AREAS IN IOWA,
Energy and Mineral Resources Research Inst., Ames, IA. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5B.
W79-08611

POTENTIAL POLLUTION OF A MARINE ENVIRONMENT BY LEAD ALKYLS: THE CAVTAT INCIDENT,
Istituto di Ricerca sulle Acque, Bari (Italy).
G. Tiravanti, and G. Boari.
Environmental Science and Technology, Vol. 13, No. 7, p 849-854, July 1979. 2 fig, 2 tab, 43 ref.

Descriptors: *Lead, *Pollutants, *Water pollution effects, Water pollution, Oceans, Sea water, Chemicals, Effects, Marine biology, Fish, Algae, Bacteria, Crustaceans, Sampling, Chemical analysis, Ships, *Yugoslavia, *Cavtat, *Adriatic Sea, Lead compounds, Tetramethyllead, Tetraethyllead.

The 2,000-ton Yugoslav cargo ship Cavtat, containing about 325 tons of lead alkyl antiknock compounds, sank on July 14, 1974, in 94 m of water, 3.5 miles southeast of the Ontario Cape, in the Adriatic Sea. The organic nature of this load gave rise to pollution problems that had not yet been considered in the literature. A significant release of lead alkyls was prevented by salvaging the material, with a loss of only 7%. A preliminary evaluation of the potential polluting effects of lead alkyl dispersion in the marine environment was reported, solid evaluation being based on a diffusion/convection transport model which allows the compound hypothetical concentration distribution in the wreck area to be calculated. Analysis of seawater, sediments, and biological samples near the wreck, using standard analytical methods, verified that there was little environmental effect. (Sims-ISWS)
W79-08627

ENVIRONMENTAL EFFECTS OF WESTERN COAL COMBUSTION PART II - THE AQUATIC MACROINVERTEBRATES OF ROSEBUD CREEK, MONTANA,
Montana State Univ., Bozeman. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-08658

THE ACUTE TOXICITY OF ZINC TO RAINBOW AND BROOK TROUT. COMPARISONS IN HARD AND SOFT WATER,
Environmental Research Lab., Duluth, MN.
G. W. Holcombe, and R. W. Andrew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 939, Price codes: A03 in paper copy, A01 in microfiche. U.S. Environmental Protection Agency, Report EPA 600/3-78-094, 17 p, 1978. 4 tab, 32 ref.

Descriptors: *Zinc, Metals, *Toxicity, Bioassay, *Brook trout, *Rainbow trout, Laboratory tests, Freshwater fish, Hydrogen ion concentration, Alkalinity, *Hardness(Water), Soft water, Hard water, Water quality, Methodology, Zinc toxicity, Water pollution effects.

The means and ranges of the 96-hour LC50's derived from three tests were 0.55 (0.37 to 0.76) and 2.5 (1.9 to 3.0) mg Zn/liter for rainbow and 2.0 (1.6 to 2.4) and 6.0 (5.0 to 7.0) mg Zn/liter for brook trout in soft and hard water, respectively. Based on overall means, brook trout were approximately 2.7 times more resistant than rainbow trout. Zinc toxicity to both species increased with increasing pH, and decreased with increasing hardness and alkalinity. (Katz-EIS)
W79-08659

CHANGES IN PLANKTON AND BENTHOS OF THE SEA OF AZOV UNDER THE INFLUENCE OF ANTHROPOGENIC FACTORS,
Azovskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Rostovna-Donu (USSR).
For primary bibliographic entry see Field 5A.
W79-08660

A NEW UNITED STATES BIOMONITORING SYSTEM FOR THE AQUATIC ENVIRONMENT,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W79-08661

PHYTOPLANKTON IN THE NOVO-BAVARSKOYE RESERVOIR AS AN INDICATOR OF TYPE AND THE BIOLOGICAL-SANITARY CONDITION OF A LAKE,
Kharkov State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W79-08662

EFFECT OF PESTICIDES AND NARCOTANTS ON BIVALVE MOLLUSCS,
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
U. H. Mane, M. S. Kachole, and S. S. Pawar.
Malacologia, Vol. 18, p 347-360, 1979. 4 fig, 5 tab, 3 ref.

Descriptors: *Toxicity, Bioassay, Laboratory tests, Molluscs, *Commercial shellfish, Water pollution effects, Marine fisheries, Marine animals, *India, *Pesticides, *Narcotants, DDT, Chlorinated hydrocarbon pesticides, Malathion, Phosphioate, Pesticides, Phenobarbital, Hexobarbital, Path of pollutants, Katyelsia, Donax, Water pollution sources.

The reactions of the marine bivalves Katelysia opima and Donax cuneatus (both commercially important species in India), to various pesticides and narcotants were studied under laboratory conditions. Reactions varied, but thiometon and malathion were found to have the least effect on K. opima and D. cuneatus, respectively, while malathion and DDT were found to be more toxic to K. opima and D. cuneatus, respectively. D. cuneatus was little affected by the narcotics phenobarbital sodium and hexobarbital sodium, but K. opima was affected by phenobarbital sodium. The commercially important freshwater bivalve Indinaia caeruleus was studied in detail as regards the influence of polluting substances on the neurosecretory cells, the digestive gland and the intestine. All organs were affected in different ways. (Katz-EIS)
W79-08663

DETERMINATION OF PENTACHLOROPHENOL IN MARINE BIOTA AND SEA WATER BY GAS-LIQUID CHROMATOGRAPHY AND HIGH-PRESSURE LIQUID CHROMATOGRAPHY,
Environmental Research Services, Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W79-08664

THE EFFECTS OF HALOGEN TOXICANTS ON SURVIVAL, FEEDING AND EGG PRODUCTION OF THE ROTIFER BRACHIONUS PLICATILIS,
Woods Hole Oceanographic Inst., MA.
J. M. Capuzzo.
Estuarine and Coastal Marine Science, Vol. 8, p 307-316, 1979. 2 fig, 7 tab, 24 ref.

Descriptors: Water pollution effects, *Zooplankton, Toxicity, Mortality, Bioassay, *Chlorine, Chlorination, Halogen, Rotifers, Plankton entrainment, Animal physiology, Reproduction, Water temperature, Residual chlorine, Brachionus, *Chloramine.

The toxicity of free chlorine and combined chlorine as chloramine to the rotifer Brachionus plicatilis at three exposure temperatures has been evaluated. Chloramine was more toxic to rotifers than the free halogen form with LC50 values for 30-min exposures at 20 C of 0.35 mg/l applied chloramine and 1.20 mg/l applied free chlorine, 0.02 mg/l and 0.18 mg/l residual levels, respectively. The synergistic effect of temperature on the toxicity of both halogen forms was also noted. Rotifers surviving exposure to either halogen toxicant had significantly lower filtration rates and egg production rates than control animals. The reduced reproductive rates were not sustained by the second generation of rotifers and it appears that exposure to free chlorine or chloramine does not result in a permanent alteration in the reproductive potential of rotifer populations. (Katz-EIS)
W79-08665

THE WEST FALMOUTH OIL SPILL: HYDROCARBONS IN THE SALT MARSH ECOSYSTEM,
Victoria Ministry for Conservation, Melbourne (Australia).
For primary bibliographic entry see Field 5A.
W79-08666

THE ECOLOGY AND REPRODUCTIVE EFFICIENCY OF THE SIBERIAN STURGEON, ACIPENSER BAERI, IN THE OB AS AFFECTED BY HYDRAULIC ENGINEERING WORKS,
Siberian Research Inst. of Pisciculture, Tymen (USSR).
N. P. Votinov, and V. P. Kas'yanov.
Journal of Ichthyology, Vol. 18, No. 1, 1978. p 20-29. 3 fig, 10 tab, 14 ref. (Translation from Russian).

Descriptors: Freshwater fish, *Sturgeon, *Dams, Damsites, *Reproduction, Commercial fisheries, *Upper Ob River, Spawning, *Stream flows, Peak flows, Hydrology, Hydraulic structures, Hydraulic engineering, Juvenile fish, Sturgeon larvae.

Results of observations carried out on the reproduction of the Siberian sturgeon, Acipenser baeri, in the upper Ob River and on the downstream migration of its young during the period 1968-1974 are presented. The direct relationship between water levels in the region of the spawning grounds during the spawning period and year-class strength for the respective years is established. The reduction in recruitment as a result of dams, is mainly due to a shift in the times of peak flows and a reduction in the peak flows. (Katz-EIS)
W79-08667

CHANGES IN THE PHYTOPLANKTON OF AN ENGLISH LAKE, 1945-1977,
Freshwater Biological Association Ambleside (England).
For primary bibliographic entry see Field 5B.
W79-08668

AIR-POWERED STREAM TANK FOR LABORATORY USE,
Toronto Univ., (Ontario). Div. of Life Sciences.
For primary bibliographic entry see Field 5B.
W79-08669

LEAD ACCUMULATION IN AQUATIC PLANTS FROM METALLIC SOURCES INCLUDING SHOT,
Montana Univ., MO. Dept. of Botany.
For primary bibliographic entry see Field 5A.
W79-08670

PECULIAR ACCUMULATION OF COBALT-60 BY THE BRANCHIAL HEART OF OCTOPUS,
National Inst. of Radiological Sciences, Nakamin-

ato (Japan). Marine Radio-Ecological Research Station.
For primary bibliographic entry see Field 5A.
W79-08671

EXPOSURE OF FINGERLING SPRING CHINOOK SALMON TO MIXTURES OF FURANACE-10, QUINALDINE, AND MS-222,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
G. M. Matthews.
The Progressive Fish Culturist, Vol. 41, No. 2, p 85-86, 1979. 2 ref.

Descriptors: *Mortality, *Antibiotics(Pesticides), *Chinook Salmon, *Anesthetic agents, *Furanace-10, Aquiculture, Bactericides, Fungicides, Fish physiology, Fish handling facilities, Fry, Fish hatcheries, Chemical properties, Chemical analysis, Fish behavior.

This study examines the efficacy of the broad-spectrum anti-microbial agent Furanace-10 in preventing the high pathogen-related mortality frequently associated with the crowded conditions of fish hatcheries and research operations. In order to test for possible synergistic effects fingerling chinook salmon were exposed to three different mixtures of Furanace-10 and anesthetic agents (Furanace-10 and MS-222, Furanace-10 and quinaldine, Furanace-10 and a mixture of the two anesthetics). None of the three mixtures tested conspicuously altered behavior or caused significant immediate mortality. It therefore apppears that solutions of three chemicals could be used safely as baths or dips for experimental purposes. (Deal-EIS)
W79-08676

TOXICITY OF SWASCOL (TRADE NAME) 1P (SLS) TO CHANNA PUNCTATUS AND CIRRHINA MRIGALA: BIOCHEMICAL ALTERATIONS,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5A.
W79-08677

EFFECT OF THERMAL EFFLUENTS AND RETENTION TIME ON LAKE FUNCTIONING AND ECOLOGICAL EFFICIENCIES IN PLANKTON COMMUNITIES,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
For primary bibliographic entry see Field 5A.
W79-08678

SUCCESSION OF AQUATIC INSECTS CAUSED BY MILD ORGANIC POLLUTION IN RIVERS (IN JAPANESE),
Freshwater Fisheries Lab., Tokyo (Japan).
H. Tanaka.
Bulletin of the Freshwater Fisheries Research Laboratory, Vol. 28, No. 2, p 141-153, 1978. 1 fig, 6 tab, 16 ref. (English Summary).

Descriptors: Benthos, *Aquatic insects, On-site-investigations, Japan, *Water pollution effects, *Stoneflies, *Mayflies, Animal grouping, Animal populations, Sampling, Organic wastes, *Organic pollution, Freshwater benthos.

Studies of aquatic insect populations were conducted between 1958 and 1976 in rivers which were not polluted, mild pollution and moderate pollution. An attempt was made to correlate aquatic insect population with the degree of pollution. Insects of the authors group I, which were mostly stoneflies, dominated in unpolluted streams. Insects of group II, which included mayflies, dominated in the mildly polluted streams, while insects of both groups were observed in very mildly polluted streams. The distribution of both groups were not affected by the altitude. (Katz-EIS)
W79-08679

EFFECT OF OXYGEN SUPPLY IN CONCRETE PONDS ON ENVIRONMENTAL FACTORS AND PRODUCTION OF FISH BY FEEDING (IN JAPANESE),
Freshwater Fisheries Research Lab., Tokyo (Japan).
For primary bibliographic entry see Field 5A.
W79-08680

PESTICIDE AND PCB OF COMMON EIDER, HERRING GULL AND GREAT BLACK-BACKED GULL EGGS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5B.
W79-08683

ICHTHYOTOXICOLOGICAL EVALUATION OF THE ELECTROCONDUCTIVE RESIN, (IN BOHEMIAN),
Vyzkumny Ustav Rybarsky a Hydrobiologicky, Vodnany (Czechoslovakia).
M. Bohm, Z. Svobodova, and J. Tauc.
Buletin VURH Vodnany, Vol. 15, No. 1, p 33-37, 1979. 2 fig. (English summary).

Descriptors: *Toxicity, *Chemical wastes, *Fish physiology, *Electrophoresis, *Poecilia, Guppies, Bioassay, Carp, Rainbow trout, Mortality, Hazards, Poisons, Chemical analysis, Chemical properties, Resins, Electroconductive resin, ECR paper, Kaolin.

The electroconductive resin ECR 77 is intended for use in the one step production of electrophoreographic paper. From the ichthyotoxicological view-point, this substance is highly toxic for fish. The LC50 for the carp within 48 hours is 27.2 mg/l, for the rainbow trout 4.2 mg/l, and for Poecilia reticulata 3.7 mg/l. Caolin was added to this resin in a 1:4 ratio to inactivate the poison. The toxicity of the ECR-77 paper for fish, as influenced by the coagulating action of caolin, is about 3-7 times lower than that of untreated ECR-77 paper. Despite this, the resin of ECR-77 remains a potential hazard to the quality of Czechoslovak waters. (Deal-EIS)
W79-08684

THE ROLE OF ENVIRONMENTAL ASSESSMENT IN A MAJOR PULPMILL EXPANSION PROGRAM,
Kimberley-Clark of Canada, Ltd., Terrace Bay (Ontario).
C. F. Gorham.
In: Proceedings of the 24th Ontario Industrial Waste Conference, held May 30-June 1, 1977, Toronto, Canada. p 24-45, 1977. 1 fig.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Water pollution sources, *Lumbering, *Waste water treatment, Treatment facilities, Dissolved oxygen, Environmental effects.

The environmental impact of a pulpmill expansion program was investigated by Kimberly-Clark of Canada Limited. The production facilities at the Terrace Bay mill were expanded from 425 tons/day to 1250 tons/day. Although the mill effluent will triple in quantity, the net effect on the Moberly Bay is expected to decrease because of increased in-plant controls and the polishing action of the present lagoon system. The impact of increased logging activity on the Long Lake - Aguasabon River system may cause a number of problems including the smothering of benthic invertebrate and fish spawning beds with bark, and the reduction of dissolved oxygen levels through decomposition of bark and logs. Increased logging could cause increased potential for forest fires and impact on wildlife. The effects of growth in the town's population are explored. (See also W79-08701) (Small-FRC)
W79-08702

SILVICULTURAL CHEMICALS AND PROTECTION OF WATER QUALITY.
Oregon State Univ., Corvallis. School of Forestry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 923, Price codes: A11 in paper copy, A01 in microfiche.
Report EPA-910/9-77-036, 1977. 232 p, 10 fig, 6 tab, 124 ref, 4 append.

Descriptors: *Forest management, *Pesticides, *Herbicides, *Water pollution sources, *Toxicity, Water quality, Soil management, Erosion control, Organic pesticides.

A comprehensive review of silvicultural chemicals management practices is presented, and chemicals are evaluated in relation to both water quality and silviculture objectives. Various procedures are outlined that permit reaching management goals without adverse impacts on water quality. Pollution control guidelines are presented, and criteria are proposed for limiting concentrations of chemicals in water. The toxicological properties of the major forestry chemicals are reviewed including specific data on a wide variety of organisms. Serious water quality impacts are avoided by limiting the use of organochlorine insecticides and by avoiding the direct application of insecticides to open water. Adequate buffer strips and special application techniques near water are recommended. The use of herbicides which control vegetation but do not cause siltation or other soil damage is recommended. Also, priority should be given to the training and licensing of applicators. (Small-FRC)
W79-08769

WASTE MANAGEMENT OPERATIONS, SAVANNAH RIVER PLANT, AIKEN, SOUTH CAROLINA.
Department of Energy, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-08780

MARKET STRUCTURE AND EXTERNALITIES: THE CASE OF WATER POLLUTION IN ENGLAND AND WALES,
D. J. Storey.
The Journal of Industrial Economics, Vol. 27, No. 2, December 1978, p 149-161. 1 fig, 2 tab, 22 ref, 2 append.

Descriptors: *Economics, *Market structure, *England, *Wales, *Externalities, *Water pollution control, Costs, Industrial wastes, Effluents, Pollution abatement, Rivers, Regression analysis, Regulation, Profit maximization, Waste disposal, Waste treatment, Behavior, Law enforcement, Competition, Motivation, Policy, Governments.

This paper analyzes effects of relaxing two significant assumptions of externality theorists in regard to pollution control: (1) that both dischargers and enforcement bodies play purely passive roles; and (2) that all polluters are profit maximizers (cost minimizers) operating in a perfectly competitive selling market. Within profit-maximizing polluters can use resources in opposing the authority; firms in noncompetitive industries will have an advantage in such conflicts over small competitive companies. Replacement of the profit-maximizing hypothesis with one in which managers act like private citizens, and make descretionary expenditures results in opposite predictions. These hypotheses were tested with the case of water pollution control in England and Wales. Regression analysis showed a U-shaped relationship between pollution control expenditures and at least one index of market imperfections, leading to several conclusions: (1) neither market structure nor the role of the enforcing authority can be omitted from externality analysis. (2) water quality improvement may not have been achieved in a cost-effective way since under a system of regulation the middle concentration firms will always have an incentive to challenge the authority rather than install equipment, (3) water pollution generated by imperfectly competitive firms may not be a true externality, and (4) antitrust policies may increase social damage from pollution through inhibiting discretionary spending on abatement. (Lynch-Wisconsin)
W79-08808

SEASONAL AND DEPTH DISTRIBUTION OF LIMNOCALANUS MACRURUS AT A SITE ON WESTERN LAKE SUPERIOR,
Washington State Univ., Pullman. Dept. of Bacteriology and Public Health.
J. B. Conway.
Journal of Great Lakes Research, Vol. 3, No. 1-2,

p 15-19, 1977. 3 fig, 2 tab, 3 ref.

Descriptors: *Lake Superior, *Limnocalanus macrurus, *Copepods, *Life history studies, *Depth, *Seasonal, Growth stages, Copepodids, Calanoidea, Zooplankton, Great Lakes, Lakes, Distribution, Biomass, Ecology, Baseline studies, Morphology, Minnesota, On-site investigations.

The relict calanoid copepod Limnocalanus macrurus was studied 1970-71 in western Lake Superior, 0.8 km offshore from Larsmont, Minnesota. Copepodid stages I-IV are most numerous prior to July, stage V in July, and stage VI August-September. L. macrurus's contribution to total crustacean zooplankton biomass increases with depth, and is frequently dominant at 40-50 m. Midday samples when light is maximal show that most copepodids of a specific stage prefer a particular depth which increases with maturity of the stage. At five meters, where crustacean zooplankton biomass reaches maximum volume in August-September, L. macrurus contributes little, but plays an increasingly greater role with depth. Total zooplankton biomass decreases with depth. Samples were collected at depths of 5, 10, 20, 30, 40, and 50 m with Clarke-Bumpus plankton samplers. Stage VI copepodids are numerous at every depth except five m, and numbers generally increase with depth due to female increase; male stage VI copepdid numbers remain relatively constant. The male-to-female ratio of stage V is 1:1.1, and of VI, 1:2.7. The length-weight regression for L. macrurus, used to measure its contribution to total zooplankton biomass, is: Log sub 10 dry wt (mu-g) = 0.98 length (mm) - 0.79. (Lynch-Wisconsin)
W79-08812

PROPERTIES OF AN AQUATIC MICRO-ECOSYSTEM: I. GENERAL INTRODUCTION TO THE PROTOTYPES,
Amsterdam Univ., (Netherlands). Limnology Lab.
J. Ringelberg, and K. Kersting.
Archiv fur Hydrobiologie, Vol. 83, No. 1, p 47-68, May 1978. 6 fig, 1 tab, 36 ref.

Descriptors: *Ecosystems, *Experimental ecosystems, *Analytical techniques, *Algae, *Zooplankton, *Bacteria, *Research equipment, Population dynamics, Daphnia magna, Cladocera, Chlorella vulgaris, Scenedesmus quadricauda, Degradation(Decomposition), Trophic level, Methodology, Phytoplankton, Herbivores, Grazing, Phosphates, Nutrients, Phosphorus, Buffering, Reviews, Photosynthesis, Mineralization, Cycling nutrients, Biological communities, Chlorophyta.

Two prototype experimental ecosystems, small- and large-scale, each consisting of three interconnected aquaria containing separate populations of autotrophs, herbivores, and decomposers. In tests of the large prototype, volumes of the three aquaria were 100 l, 7.5 l, and 56 l; flow rates of 0.3 and 0.9 l/hr were tested, with dilution times for the three units of 13.7 and 4 7 days, 1.0 and 0.36 days, and 7.7 and 2.6 days. The small prototype had volumes of six, 1.8, and 1.8 l flow rate of 0.03 l/hr, and dilution times in the three units of 8.6, 2.6, and 2.6 days. In the large system the algal subsystem was inoculated with pure cultures of Chlorella vulgaris and Scenedesmus quadricauda, but other algae soon entered the system. The small prototype's algal unit was filled with C. vulgaris. Both systems' herbivores consisted mainly of Daphnia magna. Most microsystems described in the literature lack a sufficiently long lifetime in a stable or predictable state, thought to be due to excessivly easy accessibility of consumers to producers. The prototypes largely overcome this problem; set up in 1973, they remain in good condition. High mineralization and steady-state algal biomass are maintained. Though a dense daphnid population may be present, it fluctuates greatly. The decomposer unit of the large prototype developed a high buffering capacity; inorganic phosphate output was constant, for example, regardless of a variable input of organic phosphorus. In the small prototype biomass cycles of algae and daphnids were observed. (Lynch-Wisconsin)
W79-08816

NITRATE EXCRETION BY A BLUE-GREEN ALGA, OSCILLATORIA REBESCENS D.C.,
Tokyo Univ. (Japan). Ocean Research Inst.
M. Ohmori.
Archiv fur Hydrobiologie, Vol. 83, No. 4, p 485-493, September 1978. 5 fig, 1 tab, 21 ref.

Descriptors: *Oscillatoria rubescens, *Nitrites, *Nitrates, *Lake Schoh(West Germany), *Excretion, Assimilation, Cyanophyta, Algae, Phytoplankton, Plant growth, Growth rates, Metalimnion, Lakes, West Germany, Light intensity, Photoperiodism.

Nitrite excretion by the cyanophyta Oscillatoria rubescens in laboratory tests and in Lake Schoh, West Germany, correlated inversely with light intensity, and was affected by algal growth rate and phase and nitrate concentration. Metalimnetic nitrite maxima may be due in part to O. rubescens, which often occurs there. Growth of the algal cells with nitrate concentrations of 140 mg N/l at 20 C at light intensities ranging from 400-3500 lux led to accumulation of nitrite in the culture medium at up to seven mg N/l. Ammonia was assimilated more rapidly, but no nitrite accumulation resulted. Nitrite was produced by O. rubescens when incubated in Lake Schoh at depths of 3.8, 7.5, and 10.0 m in July 1975; the highest nitrite concentration (0.58 mg N/l) was observed at 7.5 m. Results show that Oscillatoria contributes to the formation of nitrite maxima in lakes by assimilatory reduction of nitrate. Algal cultures were grown in Zehnder's mineral medium at pH 8.3, to which potassium nitrate was added. Light was either continuous or intermittent (16 hrs light, eight hrs darkness). With continuous light at 400 lux, nitrite in the medium increased to a maximum of four mg N/l after 30 days, then decreased; after 50 days, only trace amounts of nitrite remained. With the light-dark cycle, the rate of nitrite accumulation was lower, but the maximum was attained later and was much higher (seven mg N/l). Both nitrite production and algal growth rate were inversely correlated with light intensity. (Lynch-Wisconsin)
W79-08817

A DIURNAL STUDY OF THE PHYTOPLANKTON IN THE EUTROPHIC LAKE LOVOJARVI, SOUTHERN FINLAND,
University Coll. of North Wales, Bangor. School of Plant Biology.
R. I. Jones, and V. Ilmavirta.
Archiv fur Hydrobiologie, Vol. 83, No. 4, p 494-514, September 1978. 10 fig, 4 tab, 44 ref.

Descriptors: *Lovojarvi(Finland), *Phytoplankton, *Eutrophication, *Vertical distribution, *Methodology, *Photosynthesis, *Analytical techniques, Measurement, Lakes, Finland, Diurnal, Epilimnion, Euphotic zone, Distribution, Primary productivity, Respiration, Stratification, Chlorophyll, Hydrogen ion concentration, Carbon radioisotopes, Light-dark bottle method, Dissolved oxygen, Oxygen demand.

Rather weak diurnal changes in the vertical distribution of phytoplankton in the epilimnion of Lovojarvi, a eutrophic lake in southern Finland during a 24-hr study 11-12 August 1976, are attributed to water column stability, the small proportion of motile individuals, and the rather shallow euphotic zone. Rates of photosynthesis were considerably underestimated during long experiments in experimental enclosures, but no satisfactory solution was found for obtaining daily rates from shorter exposures. Use of the carbon-14 and oxygen methods for measuring photosynthesis gave results which agreed qualitatively, but which compared poorly in terms of quantity. Reliable measurements of net photosynthesis were not possible by either method. It was impossible to correct carbon-14 results for respiratory losses by using the loss of carbon-14 in the dark to estimate respiration. The water column was strongly stratified both thermally and chemically. Changes in concentration of oxygen and pH during the day were noticeable in surface waters as a result of biological activity. The chlorophyll-a content of cells did not appear to vary with time. At the bottom of the euphotic zone a distinct algal community was found which was adapted to the low irradiance through higher cell chlorophyll content. The study day was divided into five periods, with sampling at 9 am, 2 pm, 7 pm, and 10 pm 11 August, and 4 am 12 August. (Lynch-Wisconsin)
W79-08818

CALORIC CONTENT AND ELEMENTARY COMPOSITION OF SESTON OF THREE DUTCH FRESHWATER LAKES,
Amsterdam Univ. (Netherlands). Limnological Lab.
G. M. Hallegraeff.
Archiv fur Hydrobiologie, Vol. 83, No. 1, p 80-98, May 1978. 6 fig, 3 tab, 35 ref.

Descriptors: *Trophic level, *Seston, *New phytoplankton, *Caloric, *Barlosche Kolk(Netherlands), *Pool't Hammertje(Netherlands), *Lake Maarsseveen(Netherlands), Netherlands, Lakes, Phytoplankton, Algae, Eutrophication, Weight, Calorimetry, Floral lists, Detritus, Nitrogen, Phosphorus, Indicators, Chemical analysis.

Determination of dry weight, calorica content, and elemental composition of seston in three freshwater Dutch lakes of widely different trophic level showed: (1) good agreement between caloric equivalents calculated from chemical data and directly from microbomb calorimetry; (2) total seston had a strikingly lower caloric content than net phytoplankton; and (3) the nitrogen/phosphorus ratio of seston may be a macroscopic indicator of lake dynamic trophic state. The lower caloric content of the seston is attributed to their high ash content and low organic detritus content. Lakes studied were, in order of decreasing fertility, Pool 't Hammetje, Barlosche Kolk, and Lake Maarsseveen. They were sampled from early spring to late summer 1973-75 at 2-5 week intervals. Dry suspended particulate matter was 3.3-18.8 mg/l in Pool 't Hammetje, 1.2-17.0 mg/l in Barlosche Kolk, and 0.4-1 4 mg/l in Lake Maarsseveen. Caloric equivalents of seston ranged 1.44-3.98 cal/mg dry wt, compared with 12-59% fortotal seston. The organic fraction of net phytoplankton contained 4.62-5.74 cal/mg dry wt, and of total seston 2.67-5.29 cal/mg dry wt. Application of caloric values derived from field samples to the study of energy flux through aquatic ecosystems should be done with caution. Nitrogen/phosphorus content of seston showed significant variation among lakes and by season. (Lynch-Wisconsin)
W79-08819

BUOYANCY REGULATION BY PLANKTONIC BLUE-GREEN ALGAE IN LAKE MENDOTA, WISCONSIN,
Purdue Univ., Lafayette, IN. Dept. of Biological Sciences.
A. Konopka, T. D. Brock, and A. E. Walsby.
Archiv fur Hydrobiologie, Vol. 83, No. 4, p 524-537, September 1978. 6 fig, 4 tab, 20 ref.

Descriptors. *Lake Mendota(WI), *Buoyancy, *Gas vehicles, *Light intensity, *Eutrophication, *Cyanophyta, Lakes, Madison(WI), Wisconsin, Phytoplankton, Algae, Surface waters, Epilimnion, Euphotic zone, Winds, Aphanizomenon flos-aquae, Anabaena circinalis, Microcystis aeruginosa, Filamentous algae, Plant morphology, Plant physiology, Summer, Stratification, Vertical distribution, Photosynthesis, Turgor pressure, Mixing.

Planktonic blue-green algae in eutrophic Lake Mendota (Madison, Wisconsin), studied July-November 1976, lost buoyancy through collapse of gas vehicles during periods of calm water in response to increased light intensity. Blooms of Aphanizomenon flos-aquae, Anabaena circinalis, and Microcystis aeruginosa were present throughout the study period. During windy periods when colonies were mixed throughout the epilimnion, algae are always buoyant due to the gas vesicles. At onset of calm conditions this buoyancy causes the algae to accumulate in surface waters, whereupon exposure to high light intensities increased photosynthesis and cell turgor pressure; the latter collapses some of the pressure-sensitive gas vesicles. All species do not respond equally to effects of light upon buoyancy, and the amount of light required to trigger buoyancy loss is not constant

over the summer. Buoyancy regulation sometimes results in subsurface population maxima of Aphanizomenon in the early afternoon. Measurements of buoyancy, cell turgor pressure, and gas vesicle strength after incubation of A. flos-aquae at the lake's surface demonstrates that an increase in cell turgor pressure causes sufficient collapse of the weakest gas vesicles to render the algal filaments nonbuoyant. The gas vesicles are hollow, rigid, pressure-sensitive structures composed of a proteinaceous membrane impermeable to liquid water but permeable to gases; in quantity they can decrease the alga's density to less than that of water. (Lynch-Wisconsin)
W79-08820

LONG TERM STUDIES ON NITROGEN IN TWO RESERVOIRS RELATED TO FIELD FERTILIZATION,
Ceskoslovenska Akademie Ved, Prague. Hydrobiological Station.
L. Prochazkova.
Progress in Water Technology, Vol. 8, No. 4/5, p 101-109, 1977. 7 fig, 15 ref.

Descriptors: *Agricultural runoff, *Fertilization, *Slapy Reservoir(Czechoslovakia), *Klicava Reservoir(Czechoslovakia), *Nitrogen, *Water pollution sources, *Czechoslovakia, *Watersheds(Basins), Nutrients, Crop production, Fertilizers, Nitrates, Ammonia, Organic compounds, Rivers, Stratification, Seasonal, Discharge(Water).

A highly significant correlation was found between mean nitrate levels in Slapy and Klicaca reservoirs, Czechoslovakia, and the amount of nitrogen applied to the watershed in agricultural fertilizers. Nitrate, ammonia, and organic nitrogen concentrations were monitored every three weeks for 16 years in 1310-ha Slapy Reservoir (1959-74), and for 12 years in 70-ha Klicava Reservoir (1959-70); nitrates were the only form which reflected increasing inputs of nitrogen in fertilizers. Annual mean nitrate nitrogen levels showed a strong positive correlation with both the amount of nitrogen used annually per ha farmland and with percentage of farmland in the respective watersheds. Inclusion of water discharge improved the correlation between nitrates and fertilization during winter (October-March), but not during summer stratification. The latter may be due to: (1) higher vegetative activity in summer, (2) the fact that stratification sometimes permits inflowing water to pass through the reseroir without reaching the surface layer, (3) higher evaporation in the watershed in summer and decreased vertical water movement in soil, and (4) possible utilization of nitrate-nitrogen by phytoplankton during photosynthesis, perhaps influenced by the amount of available ammonium-nitrogen. Human nitrogen inputs to Klicava Reservoir are estimated at 2-3 mg/ha/yr, 5-10% of input levels from fertilizers. Mean specific discharge from farmland in the Slapy watershed is estimated at 10-12 kg N/ha/yr. (Lynch-Wisconsin)
W79-08821

THE CONTRIBUTION OF NUTRIENT FROM DIFFUSE SOURCES,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
K. S. Nielsen, and N. Nyholm.
Progress in Water Technology, Vol. 8, No. 4/5, p 111-117, 1977.

Descriptors: *Nutrients, *Nonpoint pollution, *River flow, *Denmark, *Nitrogen, *Phosphorus, *Methodology, *Analytical techniques, Rivers, Streamflow, Nutrient flux, Gjeldbaek(Denmark), Vol-baek(Denmark), Norre A(Denmark), Fyn(Denmark), Jylland(Denmark), Regression analysis, Statistical models, Model studies, Equations, Norreaen(Denmark).

Polynomial regression analysis of data on nutrient inputs from nonpoint sources to four Danish watercourses show a linear relationship between river flow and flux of both nitrogen and phosphorus. Statistical models were used in the analysis since no causal models were available. Since the statistical models are area-specific to a certain degree, other studies should include local measurements. Watercourses studied were 12-sq km Gjeldbaek (GBK), 11-sq km Vol-baek, and 138-sq km Norre A (Verjum-Alum) in Jylland, and 10 areas in Fyn; monitoring was conducted 1973-74. By simple polynomial regression nutrient flux in g/sec and river flow in cu m/sec as a function of day number (t) was fitted to the equation $F(t) = A + Bt + Ct$ squared. Annual nitrogen and phosphorus in runoff for Jylland are 2980 and 51 kg/sq km in Gjeldbaek, 2170 and 23 kg in Vol-baek, and 990 and 22 kg in Norre A. Water flow for the three areas is 8.1, 4.9, and 10.0 l/sec/sq m. Estimation of the diffuse runoff for watercouses loaded with wastewater often may result in negative contributions from diffuse sources when this term is calculated as the difference between total flux and wastewater flux, possibly due to sedimentation and release from sedimen, incorporation into plant biomass, contributions from rain and groundwater, and denitrification. Two-point measurements in Norreaen showed negative phosphorus differences mainly in spring and summer when average river velocity is low and nutrients are incorporated into plant biomass. (Lynch-Wisconsin)
W79-08822

THE IMMOBILIZATION OF NITROGEN IN A WATER-SEDIMENT SYSTEM BY DENITRIFYING BACTERIA AS A RESULT OF NITRATE RESPIRATION,
Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
J. F. Van Kessel.
Progress in Water Technology, Vol. 8, No. 4-5, p 155-160, 1977. 4 tab, 8 ref.

Descriptors: *Nitrates, *Denitrification, *Bacteria, *Nitrogen, *Sediments, *Sediment-water interface, Immobilization, Respiration, Cycling nutrients, Nutrient removal, Anaerobic conditions, Manure, Agriculture runoff, Thiobacillus denitrificans, Ammonia, Ammonium, Ditches, Organic matter, Water chemistry.

A laboratory study of the immobilization of nitrate- and ammonium-nitrogen in surface water by denitrifying bacteria in sediments shows that most nitrate added to the water-sediment samples (95-97%) was removed by volatilization due to denitrification. Sediment samples were collected from two ditches, one carrying effluent from a purification plant for liquid animal manure and containing 3.36% organic matter dry wt (Sediment A), and one draining arable land and containing 1.37% organic matter (Sediment B). Twenty-ml solutions containing different amounts of ammonium chloride or sodium nitrate were added to 20-g sediment samples. The nitrate added to the tubes was consumed after 42 days of incubation for Sediment A and 25 days for Sediment B. Immobilization of labelled ammonium during the incubation periods is increased by the presence of nitrate, which functions as hydrogen acceptor. For Sediment A samples, 97.2% of added nitrate was lost due to denitrification, and for Sediment B sampes, 94.5%; the remaining part was converted into organic matter and ammonia. The quantity of immobilized ammonium nitrogen derived from Sediment A is equal to 7.3% when calculated on the added nitrate nitrogen, and from Sediment B 4.1%. Total nitrogen (nitrate- and ammonium-nitrogen) immobilized due to the addition of nitrate is about 10% of the nitrate-nitrogen added for both sediments. Interaction of water and sediment is a natural and cheap method of removing nitrate from shallow surface waters. (Lynch-Wisconsin)
W79-08823

HUNGARY'S LAKE BALATON: A PROGRAM TO SOLVE ITS PROBLEMS,
Magyar Tudomanyos Akademia, Budapest.
I. Lang.
Ambio, Vol. 7, No. 4, p 164-168, 1978. 6 fig, 7 ref.

Descriptors: *Lake Balaton(Hungary), *Recreation, *Tourism, *Water pollution effects, *Water pollution control, *Eutrophication, *Lake restoration, Hungary, Lakes, Fertilizers, Pesticides, Soil erosion, Water pollution sources, Hydrology, Climate, Algae, Aquatic weeds, Nitrogen, Phosphorus, Nutrient loading, Nutrients, Phytoplankton, Algae, Zooplankton, Fish, Crustaceans, Regional planning, Research priorities, Planning, Decision making, Governments.

In order to arrest and reverse the deterioration of Hungary's Lake Balaton, continental Europe's largest body of fresh water, a multidisciplinary environmental research program was initiated in 1975. In addition several control measures are projected, including limiting use of lake water to drinking water and recreation, with recreation subordinated to protection of the lake and its environment. All effluents, including treated ones, will be prohibited from entering the lake (and ultimately from the basin), and fertilizer and pesticide use will be curtailed. No new industries will be permitted, in the lake's cathment basin and existing ones will be modernized. Trees will be planted to reduce erosion. The lake has become increasingly eutrophic in the past decade because of: (1) a three-fold increase in tourism from 700,000 guest-days in 1965 to two million in 1975; (2) intensive application of fertilizers and pesticides (DDT) in the basin; and (3) increased transport of sediment to the ake as a result of soil erosion. The lake's shallowness (mean depth three m) and warm summers favor rapid proliferation of algae and aquatic weeds, enhanced by phosphorus and nitrogen loading. Annually 371 tons of total phosphorus 778 tons of total nitrogen enter the lake (6.2 and 13.0 kg/ha of water surface). Research will focus on: (1) factors affecting lake water quality; (2) background for decision-making based on economics, law, and other social sciences; (3) environmental factors affecting recreation and tourism; (4) synthesis of previous research; and (5) a monitoring system. (Lynch-Wisonsin)
W79-08824

GEOCHEMISTRY OF SEDIMENT/WATER INTERACTIONS OF NUTRIENTS, PESTICIDES AND METALS, INCLUDING OBSERVATIONS ON AVAILABILITY,
D. R. Bouldin.
In: Proceedings of a Workshop on the Fluvial Transport of Sediment-Associated Nutrients and Contaminants; Kitchener, Ontario, Canada, 20-22 October 1976; eds, Shear, H. and Watson, A. E. P. January 1978, International Joint Commission, Windsor, Ontario, Canada. p 235-244. 1 fig, 2 tab, 1 ref.

Descriptors: *Fall Creek Watershed(NY), *Phosphorus, *Soluble phosphorus, *Particulate phosphorus, *Streams, *Water pollution sources, Sediment transport, Sediments, Watersheds(Basins), New York, Nutrients, Nutrient loading, Lakes, Reservoirs, Particulates, Streambeds, Streamflow, Geochemistry, Sewage treatment, Point pollution, Nonpoint pollution.

Between September 1972 and September 1975 phosphorus fractions and flow were monitored in the 300 sq km Fall Creek Watershed in Central New York and in selected subwatersheds. This paper discusses three aspects of the data: (1) removal from solution of soluble phosphorus inputs from point sources during downstream movement, presumably by reaction with the streambed; (2) a procedure for allocating loading of soluble phosphorus to biogeochemical sources (natural, or background), diffuse sources (associated with human activity), and point sources (from human activity); and- (3) a rationale for the hypothesis that soluble phosphorus will have a major impact on lake biology; while phosphorus associated with particulate matter will have only a minor effect. Water samples were analyzed for molybdate-reactive phosphorus (MRP), total soluble phosphorus (TSP), and total phosphorus associated with particulate matter. High-discharge events are analyzed according to Chow's hydrograph analysis, whic separates flow into: (1) that associated with a baseflow reservoir; (2) that associated with an interflow reservoir, and (3) that associated with surface runoff. MRP in surface runoff is 34-60 mu-l, considerably higher than the six mu-l estimated for biogeochemical sources. During storms Fall Creek water often contains 500-1000 mu-p-l associated with particulate matter and 20-40 mu dissolved p/l. Evidence is presented showing soluble, not absorbed, phosphorus is the critical factor governing phytoplankton concentrations. (Lynch-Wisconsin)

W79-08825

FORMS AND SEDIMENT ASSOCIATIONS OF NUTRIENTS (C.N. AND P.) PESTICIDES AND METALS. NUTRIENTS - P,
T. Logan.
In: Proceedings of a Workshop on the Fluvial Transport of Sediment-Associated Nutrients and Contaminants; Kitchener, Ontario, Canada, 20-22 October 1976; eds, Shear, H. and Watson, A. E. P. January 1978, International Joint Commission, Windsor, Ontario, Canada. p 181-198. 5 fig, 4 tab, 19 ref.

Descriptors: *Nitrogen, *Sediment transport, *Rivers, *Water pollution sources, *Cycling nutrients, *Sediments, Nutrients, Eutrophication, Limiting factors, Carbon/nitrogen ratio, Nitrates, Ammonium, Nitrites, Ammonia, Nitrous oxide, Bioavailability, Nitrification, Denitrification, Sediment-water interfaces, Reviews, Great Lakes, Particulates.

Forms, sources, and transformations of nitrogen in fluvial systems are reviewed. Nitrogen forms identified are nitrate, nitrite, ammonium, ammonia, nitrous oxide, free nitrogen, and particulate nitrogen. Nitrogen sources include: (1) runoff and erosion, (2) tile drainage and seepage, (3) precipitation, (4) sewage, (5) livestock wastes, and (6) processing wastes. About 30-50% of nitrogen loading to the Great Lakes is from point sources, especially wastewater effluents. Sediment nitrogen is a relatively minor source of nitrogen loading to Lake Erie. Important sediment-nitrogen reactions are: (1) nitrogen fixation, (2) immobilization, (3) mineralization-ammonification, (4) nitrification, and (5) denitrification. All organisms have a characteristic carbon/nitrogen ratio, dependent on relative amounts of biomass protein. Higher plants have ratios ranging from 100:1 to 20:1, while bacteria and other microorganisms have a ratio of about 9:1. During decomposition mineral nitrogen may be assimiated or released according to the C/N ratio of the mineral being decomposed. Sediment-nitrogen transformations during fluvial transport are described during storm runoff and during winter and summer low-flow runoff. The processes of nitrogen cycling and interchange in sediments are complicated and poorly understood. Very little is known of in-situ rates and factors controlling nitrogen exchange between water and sediments. (Lynch-Wisconsin)
W79-08826

FORMS AND SEDIMENT ASSOCIATIONS OF NUTRIENTS (C.N. AND P.) PESTICIDES AND METALS. NUTRIENTS - P,
T. Cahill.
In: Proceedings of a Workshop on the Fluvial Transport of Sediment-Associated Nutrients and Contaminants; Kitchener, Ontario, Canada, 20-22, October 1976; eds, Shear, H. and Watson, A. E. P. January 1978, International Joint Commission, Windsor, Ontario, Canada. p 163-180. 8 fig, 24 ref.

Descriptors: *Phosphates, *Total phosphate, *Orthophosphate, *Particulate phosphate, *Sediment transport, *Path of pollutants, *Reviews, Channel scour, Phosphorus, Particulates, Suspended solids, Lake Erie, Great Lakes, Maumee River Basin(OH), Honey Creek(OH), River basins, Sandusky River Basin(OH), Ohio, Lakes, Rivers, Streams, Nutrient loading, Eutrophication, Sediments.

Studies of phosphate transport 1972-74 showed that: (1) total phosphate (TP) concentration increases with stream discharge, so that the phosphate chemograph parallels the hydrographs; (2) soluble phosphate behaves quite differently from TP; (3) there are often strong correlations between TP and suspended solids levels; (4) mass transport during storms accounts for a great part of total annual phosphate loadings; and (5) past methods of estimating long-term phosphate loadings based on average concentrations severely underestimate annual mass transport. Studies of Lake Erie (1975), Ohio's Maumee River Basin (1976), and Honey Creek in the Sandusky River Basin, Ohio suggest the proper focus of lake eutrophication studies is TP rather than soluble phosphate or orthophosphate. A convenient step is to partition TP into: (1) orthophosphate, and (2) TP minus orthophosphate, regarded as a rough measure of particulate phosphate. Honey Creek results illustrate an intermediate level of analysis whih stops short of attempting to specify all causes of observeo loading. Unlike TP, orthophosphate does not usually correlate positively with stream discharge (and may be inversely related). Most TP transported during storm flow occurs in association with particulate matter as measured by suspended solids. Honey Creek indicates channel scour is only a minor influence on sediment transport. (Lynch-Wisconsin)
W79-08827

FORMS AND SEDIMENT ASSOCIATIONS OF NUTRIENTS (C.N. AND P.) PESTICIDES AND METALS, NUTRIENTS - P,
H. L. Golterman.
In: Proceedings of a Workshop on the Fluvial Transport of Sediment-Associated Nutrients and Contaminants; Kitchener, Ontario, Canada, 20-22 October 1976; eds, Shear, H. and Watson, A. E. P. January 1978, International Joint Commission, Windsor, Ontario, Canada. p 157-161. 4 ref.

Descriptors: *Sediment transport, *Rivers, *Soil erosion, *Sewage disposal, *Agricultural runoff, *Phosphate, *Water pollution sources, Lakes, Rhine River, Meuse River, Sediments, Phosphorus, Bioavailability, Nutrients, Netherlands, Bioassay, Algae, Phytoplankton, Scenedesmus, Chlorophyta, Nitrilotriacetic acid, Apatite, Clays, Iron.

Dutch lakes, mostly in the Rhine and Meuse deltas, receive large amounts of nutrients from these rivers. Of 70,000 metric tons phosphate-phosphorus transported annually by the Rhine, about 7,500-9,000 metric tons accumulate in the Dutch lakes. The lakes receive annual load of about six g/sq m, 50% from the Rhine. River-borne phosphate derives from three main sources: (1) natural erosion, (2) human waste, and (3) agricultural runoff. The Rhine carries about 4,000 tons from erosion, 50,000 tons from human waste, and 1,000-10,000 tons from agricultural runoff per year. During chemical weathering the major part of erosion-derived phosphate is converted into a lattice-bound clay phosphate, apparently available to agricultural crops but not to algae. Phosphate freshly absorbed onto clay is easily available to algal cultures. In unpolluted clays phosphate-phosphorus constitutes about 0.1%. Available sediment phosphate was studied with algal bioassays using Scenedesmus. All sediment promoted good algal growth, though not all phosphate equal to that used by algae could be extracted. Iron-bound phosphate was entirely available, while apatite availability depended on crystal size. In experiments in an artificial pond, sediments released over one g/sq m PO4-P in six mo, while NTA-extractable phosphate decreased by 50%. (Lynch-Wisconsin)
W79-08828

ANTHROPOGENIC INFLUENCES OF SEDIMENT QUALITY AT A SOURCE, NUTRIENTS: CARBON, NITROGEN AND PHOSPHORUS,
M. Miller.
In: Proceedings of a Workshop on the Fluvial Transport of Sediment-Associated-Nutrients and Contaminants; Kitchener, Ontario, Canada, 20-22 October 1976; eds, Shear, H. and Watson, A. E. P. January 1978, International Joint Commission, Windsor, Ontario, Canada. p 81-93. 3 fig, 9 tab, 3 ref.

Descriptors: *Carbon, *Nitrogen, *Phosphorus, *Soil erosion, *Sediment transport, *Farm management, *Water pollution sources, *Agricultural runoff, Nutrients, Sediments, Crop production, Particle size, Agriculture, Bioavailability, Manure, Sewage sludge, Fertilizers, Fertilization, Phosphates, Cultivation.

Crop production practices significantly affect agricultural runoff and erosion and may also influence nutrient concentration in receiving sediment, either through altering its physical characteristics or altering nutrient content of surface soil and hence sediment. Sediment contains a higher proportion of finer particles and organic matter than source soil, and carbon, nitrogen, and phosphorus occur at higher levels in finer particles. Management practices which reduce runoff water carrying capacity will tend to reduce mean sediment particle size and therefore sediment nutrient concentrations. Such practices affect velocity by means of modifying surface roughness and degree of plant residue incorporation. However, practices which reduce sediment loss probably will not reduce nutrient loss proportionately. Crop production generaly reduces organic matter content of surface soil, decreasing soil stability and increasing runoff. Heavy application (without incorporation) of manure or sewagesludge temporarily increases organic matter content, but also carbon and nitrogen content of runoff, especially application in late fall or winter. Manure and fertilizer should be plowed into the soil to inhibit loss through erosion. Application of phosphorus to surface soil increases extractable phosphorus in sediment and dissolved phosphorus in runoff water. An optimal level of addition exists, above which yield is not increased. (Lynch-Wisconsin)
W79-08829

5D. Waste Treatment Processes

THE SEWERLESS SOCIETY,
H. H. Leich.
Imiesa, Vol. 1, No. 7, p 15-25, July 1976.

Descriptors: *Sewage treatment, *Waste water treatment, Sewage bacteria, Aerobic bacteria, Sewage disposal, Septic tanks, Biological treatment, Sludge treatment, Environmental sanitation, Sewage sludge, Biodegradation, Domestic wastes, Composting toilets, Biological toilets, Incineration toilets, Fertilizers.

Alternatives to the present sewage treatment system are examined. Adverse effects of the present system include: the possible transmission of diseases to water uses downstream, the wasting of large quantities of purified water, large monetary expenditures, accelerated eutrophication of lakes and estuaries, leakage of raw sewage, and build-up of large amounts of sewage sludge, and build-up of large amounts of sewage sludge. The solution to the problem seems elementary: body wastes should not be put into the public water supply, and sewage disposal systems should be decentralized. At least seven different types of sewerless toilets are on the market or under development. These include incinerating, biological, composting, and oil-flushed toilets, household collection systems, vacuum systems, and aerobic tanks. Some of these systems require no electricity, gas, or pumped-in water; others require the use of one or more. Better use of centralized sewage sludge is being investigated. Dried and composted, the sludge serves as fertilizer; experiments are piping liquid sludge to farmlands and forests where it is sprayed as fertilizer. Sludge can also be used for methane production. Because they are more economical and ecological than sewerage systems, sewerless systems are getting more attention. In the future, U.S. agencies should take a more positive view of new techology, and testing and evaluation programs should be carefully monitored. (Schaefer-IPA)
W79-08505

NGODWANA PULP MILL AND THE ENVIRONMENT,
Sappi Fine Papers, Ngodwana (South Africa).
D. Pauw.
Environment RSA (Pretoria), Vol. 5, No. 3, p 1-2, March 1978. 1 fig.

Descriptors: *Pulp wastes, *Water pollution control, *Irrigation programs, Pulp and paper industry, Waste water(Pollution), Water pollution sources, Organic wastes, Sulfur, Waste water disposal, Irrigated land, Water management(Applied), South Africa, Odor, Air pollution.

The environmental impact of the Ngodwana mill of Sappi Fine papers since its establishment in 1966 is examined. No effluent from the mill must reach the Elands River so the company decided to irri-

gate the effluent onto its own agricultural lands. The effluent was initially of an enormous volume and highly mineralized. Severe problems were encountered when the virgin veld was irrigated with the effluent; natural cover was eliminated and the veld denuded. A hard crust formed on the soil; was selected as the most salt-resistant crop. Gypsum was added to the soil to compensate for the sodium in the effluent. Five hectares were originally planted; today Ngodwana has 53 hectares planted to kikuyu. Several hundred cattle graze on the fields. The second effluent problem of the mill was odor emission from sulfur. A gas burner designed and constructed by the mill oxidizes the concentrated odorous gases. Restrictions on hunting and snaring game have produced gratifying results: the bush buck, duiker, and rheebuck once again roam freely through the township gardens at night. (Schaefer-IPA)
W79-08520

DESIGN FOR PRETREATMENT - LAND APPLICATION OF INDUSTRIAL WASTES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
M. R. Overcash, and D. Pal.
In: Water Pollution Control in Developing Countries, Proceedings of the International Conference held at Bangkok, Thailand, Feb 21-25, 1978. p 469-474. Asian Institute of Technology, Bangkok. OWRT B-100-NC(5). 14-34-0001-7173.

Descriptors: Wastewater management, *Industrial wastes, *Land application.

The methodology for the design of land application systems for a variety of waste sources is delineated. This approach accents the site-specific nature of land-based treatment, a factor which must be continually emphasized. Identification of the land limiting constituent (LLC) in each waste, determination of requisite land system costs, evaluation of costs for effective pretreatment for the LLC, and an economic balance of pretreatment-land application are the steps in design of a total system. The advantages of utilizing plant-soil systems for waste treatment are improved public health and water quality at lower costs, lower energy usage, agriculturally-based operation and maintenance requirements, and increased location sites for industrial development. (Kiger-NC)
W79-08526

BIOLOGICAL ACTIVATED CARBON...A MYTH OR A PROMISING REALITY,
Societe Lyonnaise des Eaux et de l'Eclairage (France).
F. Fiessinger.
Aqua, No. 2, p 5-7, 1979. 2 fig, 4 ref.

Descriptors: *Activated carbon, *Biologically activated carbon, *Water purification, Granular activated carbon, Water treatment, Water quality control, Trace elements, Water chemistry, Carbon, Adsorption, Organic compounds, Ozone, Granules, Biological treatment, Carbon filters, Filtration.

Biologically activated carbon (BAC), a very promising treatment associated with granular activated carbon (GAC) which optimizes biological activity is examined. With bioactivity, GAC creates a center of high microbial activity which makes it far more effective than a mere adsorbent; the amount of organic matter eliminated is increased up to 200% and the carbon's lifetime is considerably extended. Aerobic bacteria largely compose the flora responsible for the biological activity of activated carbon; anaerobic organisms may also intervene. Bacteria are attached mainly to the exterior surface of the carbon granules. Contact time is a crucial parameter; efficiency of bacterial activity increases with the length of time. Bed depth and rate of filtration are also important parameters for efficiency. Apparently, biological activity by itself is not sufficient for maintaining indefinitely a high level of efficiency of the carbon. Preozonation has been useful as a pretreatment for GAC. Ozonation transforms organics into more readily biodegradable substances and hence its overall effect is extremely positive. Elimination of natural organic acids is better with the combination of ozonation and filtration through GAC than by treatment with either. BAC also facilitates the reduction of ammonia, thereby representing a viable alternative to prechlorination. (Schaefer-IPA)
W79-08591

EXPERIENCE IN SWITZERLAND WITH ACTIVATED CARBON FILTRATION AND THE ACTIVATED CARBON REGENERATION,
M. Schalekamp.
Aqua, No. 2, p 8-12, 1979. 13 fig.

Descriptors: *Activated carbon, *Water purification, *Water treatment, Switzerland, Water quality control, Lakes, Potable water, Carbon, Adsorption, Carbon filters, Filtration, Cost analysis, Construction cost.

In Switzerland, activated carbons are principally used for the removal of organic substances and oxidizing agents, such as chlorine. Since the good efficiency of most activated carbons decrease with time, they must be regenerated or replaced. Activated carbons can be efficiently used as a second layer for rapid or slow filtration systems. Backwashing activated carbons twice a week prevents reinfection; no number of germs higher than 50 per cu cm could be measured in the lake water works of Lengg. The regeneration oven at Lengg is installed in the supplies works and employs a fluid bed process. This process has shown the lowest loss of carbon of all available processes; the effectiveness of regeneration is excellent. The regenerated carbon is slightly less effective than the new. Construction costs for the 12 activated carbon filters with a total area of 528 sq m and a daily output of 25,000 sq m totaled over $4.26 million Swiss Francs, not including the costs of the regeneration plant.The daily capital cost per cu m capacity for filtration is $17; capacity for whole lake water treatment costs $170 daily/cu m. Including 10% amortization and 6% interest, construction cost of the regeneration plant and transfer installations is $160,000 Swiss Francs annually. Water output is 40 million cu m/yr. Treatment costs at Lengg total $0.13 per cu m; total cost for filtration is $0.016 per cu m/yr. (Schaefer-IPA)
W79-08592

INTERNATIONAL RESEARCH ON ACTIVATED CARBON IN WATER TREATMENT,
Water Research Centre, Medmenham (England). Medmenham Lab.
R. A. Hyde.
Aqua, No. 2, p 13-19, 1979. 2 fig, 14 ref.

Descriptors: *Activated carbon, *Granular activated carbon, *Water purification, Water treatment, Water quality control, Trace elements, Water chemistry, Carbon, Adsorption, Organic compounds, Granules, Pesticides, Trihalomethanes, Chlorophenyls, Carbon filters, Filtration.

Research into the use of activated carbon for the removal of organic compounds from potable water supplies is examined. Use of granular activated carbon (GAC) has increased since regeneration technology has enabled the exhausted material to be reactivated and reused; also it offers a more reliable barrier than powdered activated carbon against trace levels of organic compounds. Over 700 organic compounds have been identified in drinking water; 22 of these are known or suspected carcinogens. The presence of trihalomethanes in water supplies is widespread. Using some or all of the parameters which may influence the ability of the activated carbon to remove organics from water, models have been developed in an attempt to predict the performance of GAC. GAC has successfully controlled taste and odor in many studies. For trace organics removal, a knowledge of the organics present and the behavior of the selected carbon is necessary. Chlorophenols and phenylamide and chlorinated pesticides are strongly absorbed by GAC; trihalomethanes are not strongly absorbed and investigations have studied the removal of their precursors. Bed design and plant operations can influence the performance of GAC filters. Biologically activated carbon necessitated reduced carbon quantities for dissolved organic carbon removal. Carbon can be regenerated thermally, chemically, and biologically; a new approach to regeneration uses super critical carbon dioxide. (Schaefer-IPA)
W79-08593

ADSORPTION OF TEXTILE DYES FROM AQUEOUS SOLUTION BY ACTIVATED CARBON FROM PEANUT HULLS,
Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.
W. R. Ernst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 638, Price codes: A05 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta. Project Completion Report No. ERC 01-79, January 1979. 85 p, 15 fig, 15 tab, 60 ref, 1 append. OWRT A-069-GA(1).

Descriptors: *Activated carbon, *Peanuts, *Activated carbon from peanut hulls(ACPH), Adsorption, Water pollution, Water treatment, Sawdust, Sludge, Bagasse, Dyes, Textiles, Pinebark, Waste water treatment.

The effects and production of activated carbon from peanut hulls (ACPH) were studied. Activated carbons have been effectively used to remove residual textile dye from wastewater. Three dyes, direct orange (DO), acid red (AR), and basic yellow (BY) were studied. For each dye, the effectiveness of the activated carbon was highest for carbon produced from peanut hulls and lowest for carbon produced from pinebark. The effectiveness of activated carbon made from other waste materials (pine sawdust, hardwood sawdust, sewage sludge, and bagasse) varied among dyes. Percent dye removal from aqueous solution indicated the following optimum operating conditions for producing ACPH in a laboratory: pyrolysis and activation temperature = 700C, pyrolysis time = 1 hour, activation time = 2 hours, and water rate = 0.65 gm/hr/gm peanut hulls. Overall ACPH yield is about 25% at these conditions. Although each dye behaves differently, ultimate absorption capacity is affected by pH. Isotherm experiments showed that laboratory produced ACPH could remove color from dye solutions to yield residual color concentration as low as those achievable by a high quality commercial carbon. (Schaefer-IPA)
W79-08607

PROCEEDINGS OF THE 24TH ONTARIO INDUSTRIAL WASTE CONFERENCE, HELD MAY 30-JUNE 1, 1977, TORONTO, CANADA.
Ministry of the Environment, Ontario, (1977). 371 p, 25 fig, 7 tab, 8 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Oxidation, *Activated carbon, Environmental effects, Mine water, Chemical wastes, Metallurgy.

Nineteen papers were presented at the 24th Ontario Industrial Waste Conference. Delegates attended from nine of Canada's provinces and six states. Papers which dealt with industrial waste water treatment included: a discussion of a biological oxidation treatment facility for a high saline waste stream, a discussion of an activated carbon pretreatment system for a chemical plant, a cold mill waste treatment plant description, the description of a waste water treatment plant at a nickel mine, and a discussion of the environmental effects of expansion of a pulp mill. (See W79-08702 thru W79-08706) (Small-FRC)
W79-08701

AQUEOUS EFFLUENT TREATMENT AT THE SUDBURY PROCESSING COMPLEX OF INCO LIMITED,
International Nickel Co. of Canada Ltd., Sudbury (Ontario). Ontario Div.
E. C. Nevala.
In: Proceedings of the 24th Ontario Industrial Waste Conference, held May 30-June 1, 1977, Toronto, Canada. p 130-154, 1977. 3 fig, 1 tab, 2 append.

Descriptors: *Mine water, *Mine wastes, *Waste water treatment, *Neutralization, *Settling basins, Treatment facilities, Nickel, Copper, Iron, Hydrogen ion concentration, Suspended solids.

The development of an environmentally sound new tailings disposal facility at the Copper Cliff, Ontario nickel mine is outlined. Various waste waters were investigated including urban runoff, mine waste waters, plant runoff, and tailing decant. Laboratory and pilot plant studies on treatment processes indicated that neutralization and clarification were promising processes. The Copper Cliff Creek waste water treatment plant which was ultimately built is described, and treatment results for the first year of operation are presented. The clarifiers feature internal sludge recirculation and the treated water is returned to the natural water course. Effluent quality varied in the following ranges depending upon season: pH 9.5, total Cu 0.1-0.2 mg/liter, total Ni 0.4-0.5 mg/liter, total iron 0.8-1.2 mg/liter, and suspended solids 11-15 mg/liter. (See also W79-08701) (Small-FRC)
W79-08703

OPERATION OF A COLD MILL WASTE TREATMENT PLANT,
Dominion Foundaries and Steel Ltd., Hamilton (Ontario). Pollution and Monitoring.
G. H. Rupay.
In: Proceedings of the 24th Ontario Industrial Waste Conference, held May 30-June 1, 1977, Toronto, Canada. p 155-173, 1977. 4 fig, 4 tab.

Descriptors: *Industrial wastes, *Metallurgy, *Waste water treatment, *Oily water, *Costs, Acid, Alkaline water, Treatment facilities, Performance.

A primary treatment method for cold mill wastes of the Dominion Foundries and Steel, Limited, of Hamilton, Ontario, is described. The plant process and equipment are described, and some of the problems encountered are discussed. The waste treatment system consists of oil emulsion treatment, acidic and alkaline solution treatment, and sodium dichromate solution treatment. Problems include the fact that the oil recovered has been of lower quality than expected, and that oily sludge has built up in several places. Poor thickner operation and problems in the ion exchange system also occurred. There were also some construction problems. The treatment plant and collection network cost about $7 million. The primary treatment of cold mill waste water by this method cost about 90 cents per 1000 US gallons. The plant meets effluent discharge specifications and tests indicate that a re-usable oil can be produced. (See also W79-08701) (Small-FRC)
W79-08704

DESIGN AND OPERATION OF AN ACTIVATED CARBON WASTEWATER PRETREATMENT SYSTEM,
Uniroyal Chemical, Elmira (Ontario).
K. C. Bradley.
In: Proceedings of the 24th Ontario Industrial Waste Conference, held May 30-June 1, 1977, Toronto, Canada. p 174-193, 1977. 11 fig, 2 tab, 4 ref.

Descriptors: *Activated carbon, *Chemical wastes, *Treatment facilities, *Costs, Performance, Adsorption, Biochemical oxygen demand, Phenols.

Design, construction, and operation of a carbon treatment plant at the Uniroyal organic chemical manufacturing plant in Elmira, Ontario, are described. Laboratory and pilot tests were conducted on a single counter-current pulsed bed system. The treatment plant consisted of an adsorber and an S shaped spent carbon discharge pipe. The wet side started well with few problems, but the furnace and off-gas scrubbing system start-up was much more time consuming. Capital cost of the complete system was $450,000, and operating costs have been about 20 cents/lb of chemical oxygen demand treated. As operating problems are resolved, it is believed that the system will consistently generate an effluent BOD of 10 mg/liter or better, phenolic equivalent will be well below the 20 ppb, and effluent quality in general will continue to improve. (See also W79-08701) (Small-FRC)
W79-08705

DEVELOPMENT, START-UP AND OPERATION OF A BIOOXIDATION TREATMENT FACILITY FOR A HIGH SALINE WASTE STREAM,
E. A. Sommers.
In: Proceedings of the 24th Ontario Industrial Waste Conference, held May 30-June 1, 1977, Toronto, Canada. p 194-208, (1977).

Descriptors: *Brines, *Chemical wastes, *Industrial wastes, *Oxidation, Biological treatment, Waste water treatment, Recycling, Suspended solids, Filtration, Carbon, Organic compounds.

A biological oxidation plant for treatment of waste water brine at the Sarnia propylene oxide plant of Dow Chemical of Canada is described. The plant runs with a propylene glycol removal level of 90-100% based on feed rates of up to 900 gpm and initial glycol concentrations averaging 350 ppm. TOC removals of 80% have been realized. Initially the effluent brine was recycled to a Chlor-Alkali plant. A test program is planned to test the effluent for recycling within the plant. There have been no problems with washing salt from waste sludge and the filtration system has also been trouble-free. The only problems are related to levels of suspended solids in the brine, but after tests, success has been achieved using the flocculator as a secondary clarifier. (See also W79-08701) (Small-FRC)
W79-08706

EVALUATION OF CURRENT DEVELOPMENTS IN MUNICIPAL WASTE TREATMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-770108, Price codes: A00 in paper copy, A01 in microfiche. Proceedings of a conference held January 26-27, 1977, Baltimore, Maryland, Johns Hopkins University. Technical Information Center, Energy Research and Development Administration, 1977. 121 p, 33 fig, 23 tab, 64 ref.

Descriptors: *Municipal wastes, *Irradiation, *Disinfection, *Sludge treatment, *Conferences, Biodegradation, Anaerobic digestion, Heat treatment, Viruses, Fertilizers, Pathogenic bacteria.

This symposium was organized to present information on the use of 137Cs from reactor wastes for the disinfection of municipal sewage sludge. Ten papers were presented, nine on sludge treatment. Other topics besides the irradiation of sludge that were considered include: disinfection by composting of sludge followed by land application; anaerobic digestion or long-term lagooning; the use of uncharged ammonia to inactivate enteric viruses; the fertilizer and nutritive value of thermoradiated sewage sludge; and a general overview of problems in sludge treatment and disposal. (See W79-08708 thru W79-08716) (Small-FRC)
W79-08707

THE ERDA GOAL AND WHY WE ARE HERE,
Department of Energy, Washington, DC. Div. of Nuclear Research and Applications.
D. C. Bauer.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 1-6, 1977. 1 tab.

Descriptors: *Gamma rays, *Disinfection, *Sludge treatment, *Pilot plants, Sludge disposal, Radiation, Nuclear reactors, Municipal wastes.

The division of Nuclear Research and Applications of ERDA supported a program to investigate the potential for, and to develop the technology of, using gamma radiation from 137Cs to reduce the level of pathogens in sewage sludge. The 137Cs is a waste product of a nuclear reactor. The sludge management problem is discussed including treatment and disposal. Gamma irradiation yields biological inactivation as well as enhanced settling rates and dewatering characteristics. Treatment facilities using ionizing radiation are operational at several locations. There is a pilot facility utilizing 60Co for waste water treatment in Burlington, Ontario; an electron accelerator facility near Boston which treats 2% solids sludge; and a fullscale treatment plant in Munich, Germany which also uses 60Co. (See also W79-08707) (Small-FRC)
W79-08708

SLUDGE DISINFECTION,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
C. W. Kruse.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 7-14, 1977. 2 fig, 6 ref.

Descriptors: *Disinfection, *Sludge treatment, *Sludge disposal, Anaerobic digestion, Sewage lagoons, Environmental sanitation, Oxidation, Municipal wastes.

Sludge disinfection processes are reviewed which produce partial or complete disinfection of sludge. Anaerobic digestion or long-term lagooning can reduce the pathogen viability to levels safe for some types of disposal. The destruction of organisms can be furthered by the use of heat in the normal digester range of 32 to 38 C. Digested heat-dried sludge at 375 C is near sterile if protected from postdrying conditions. Some expensive, established heat treatments produce overkill or sterilized sludge or sludge ash. These include the Zimpro wet oxidation system and the Porteus or low-pressure Zimpro system. (See also W79-08707) (Small-FRC)
W79-08709

OVERVIEW OF THE ERDA/EPA PROGRAM IN TREATMENT OF MUNICIPAL SLUDGE,
Sandia Lab., Albuquerque, NM.
H. D. Sivinski.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 15-25, 1977. 4 fig, 3 tab, 12 ref.

Descriptors: *Gamma rays, *Disinfection, *Sludge treatment, *Environmental sanitation, Municipal wastes, Laboratories, Research and development, Economics.

The Beneficial Uses Program at the Sandia Laboratories which investigates the irradiation of sludge by 137Cs, is described. The radioisotopes are a nuclear waste material. Recent pathogen reduction studies demonstrated that an irradiation dose of 1 Mrad at 23 C with oxygenation is effective in reducing pathogens, except viruses. Combined treatment of 300 krads and 55 C for 5 min with oxygenation reduced bacteria, parasite ova, and viruses to acceptable levels. The laboratory is also involved in treatment facility design. Irradiation of sludge, either liquid or composted and raw or digested, could become an important and economically feasible alternative process in many locations. (See also W79-08707) (Small-FRC)
W79-08710

SLUDGE IRRADIATION: BACTERIOLOGY AND PARASITOLOGY,
Sandia Lab., Albuquerque, NM.
J. R. Brandon, and S. L. Langley.
In: Evaluation of Current Developments in Municiple Waste Water Treatment, p 26-39, 1977. 7 fig, 4 tab, 17 ref.

Descriptors: *Gamma rays, *Disinfection, *Sludge treatment, *Bioindicators, Sludge disposal, Oxygenation.

Several types of indicator bacteria were studied in an attempt to establish treatment parameters for the irradiation of sewage sludge both liquid and composted. Also, the effects of irradiation on parasite ova were determined. Ascaris lumbricoides ova were inactivated at doses as low as 150 krads by 99%. Treatment parameters of 1 Mrad at 23C or 300 krads at 55C with oxygenation were feasible for bacterial inactivation. Under proper conditions, regrowth of pathogenic bacteria can lead to problems. Inactivated parameters for raw sludge will be determined in future studies using Ascaris ova by the measurement of embryonation ratios. Also, there are experiments planned to determine if there

is an effect of oxygenation on inactivation of parasite ova by radiation treatment. (See also W79-08707) (Small-FRC)
W79-08711

A PROGRAM TO STUDY THE INACTIVATION OF ENTERIC VIRUSES IN WASTEWATER SLUDGE,
Sandia Labs., Albuquerque, NM. Biosystems Studies Div.
R. L. Ward.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 40-53, 1977. 4 fig, 7 tab, 8 ref.

Descriptors: *Viruses, *Sludge treatment, *Ammonia, *Disinfection, Hydrogen ion concentration, Aerobic treatment, Anaerobic treatment, Public health.

The most efficient and economical methods for inactivating enteric viruses present in waste water sludge were determined. Both raw and digested sludge contain an agent with cidal activity against enteroviruses whose expression is dependent on pH. This uncharged form of ammonia greatly accelerates the rate of heat inactivation of viruses in sludge. This agent probably contributes little toward the inactivation of viruses during anaerobic digestion because anaerobic digestion typically occurs at pH 7, a pH at which ammonia is present as the nonvirucidal ammonium ion. Sludge is protective of polio virus against inactivation by ionizing radiation as well as heat. However, the simultaneous application of these two treatments causes loss of viral infectivity at greater than additive rates. This was especially true for samples which contained low concentrations of sludge. (See also W79-08707) (Small-FRC)
W79-08712

AGRONOMIC AND ANIMAL FEEDING EVALUATIONS OF THERMORADIATED SEWAGE SOLIDS IN NEW MEXICO,
New Mexico Agricultural Experiment Station, Las Cruces.
G. S. Smith, and B. D. McCaslin.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 54-60, 1977.

Descriptors: *Fertilizers, *Sewage sludge, *Disinfection, *Nutrients, *Feeds, Ruminants, Performance, Heavy metals, Crop production, Thermal radiation.

The fertilizer value and the nutritive value for ruminants was evaluated of sewage solids disinfected by thermoradiation. The thermoradiated sewage solids had a fertilizer value which exceeded that of commercial fertilizer in tests on cotton, grain sorgum, and Lehman lovegrass grown in calcareous soil. The benefits of micronutrients such as iron and zinc were evident. Sewage solids compared favorably with cottonseed meal as a supplemental feed for sheep and cattle fed fibrous, maintenance-type diets. There was no evidence of pathology or toxicity in cattle or sheep fed sewage products for up to three months or in rats fed sewage solids at levels up to 50% from weaning to young adulthood. Some heavy metals and trace metals were increased in organs and tissues of animals fed sewage solids for long periods, but the magnitude of the increase had questionable significance. (See also W79-08707) (Small-FRC)
W79-08713

MUNICIPAL SLUDGE MANAGEMENT: PROBLEMS AND RESEARCH AND DEVELOPMENT,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
D. J. Ehreth.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 61-76, 1977. 3 fig, 2 tab, 8 ref.

Descriptors: *Research and development, *Projects, *Sludge treatment, *Sludge disposal, *Environmental effects, Dewatering, Incineration, Land application, Metals, Toxicity, Byproducts.

The Environmental Protection Agency sludge management research and development program is described which encompasses four major technical areas: processing and treatment, utilization, disposal, and health and ecological effects. The program was designed to overcome environmental problems of sludge utilization and disposal options. The present state of the art is adequate to dewater sludge, and incineration is well established except for air emissions control. Coincineration of sludge plus solid waste and pyrolysis technology are just emerging. Technological gaps which exist and are being studied include the high costs of sludge processing and disposal, and methods for converting sludge into beneficial by-products. Other problems include limited confidence in the efficacy of local industrial pretreatment programs for metals removal, lack of understanding of the risks of land application, and lack of sure methods for the removal of toxicants at the treatment plant. (See also W79-08707) (Small-FRC)
W79-08714

COMPOSTING RESEARCH AND DEVELOPMENT,
National Agricultural Research Center, Beltsville, MD.
E. Epstein, and J. F. Parr.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 83-92, 1977. 3 fig, 1 tab, 8 ref.

Descriptors: *Biodegradation, *Sludge treatment, *Sludge disposal, *Land management, *Aeration, Heavy metals, Pathogenic bacteria, Fertilizers.

Land application of sewage sludge stabilized by composting is discussed. Most of the problems associated with land application such as heavy metal, organic chemical, and pathogen content, can be resolved by composting. The aerated pile method developed by the U. S. Department of Agriculture composts both raw and digested sewage sludges. Sludge is transformed into compost in about three weeks. Odors are eliminated, and pathogenic organisms are destroyed. The finished compost can be used as a low analysis fertilizer and soil conditioner. It is easy to store and handle and can be uniformly spread on land. This method can avoid the problems caused by strict limitations on disposal of sludge by incineration, fresh water dilution, and ocean dumping. (See also W79-08707) (Small-FRC)
W79-08715

COST AND EFFECTIVENESS COMPARISONS OF VARIOUS TYPES OF SLUDGE IRRADIATION AND SLUDGE PASTURIZATION TREATMENTS,
Sandia Labs., Albuquerque, NM. Isotope Applications Div.
M. E. Morris.
In: Evaluation of Current Developments in Municipal Waste Treatment, p 93-106, 1977. 10 fig, 5 tab, 5 ref.

Descriptors: *Irradiation, *Heat treatment, *Disinfection, *Sludge treatment, *Costs, Pathogenic bacteria, Performance, Viruses.

Irradiation, thermoradiation, and thermal pasturization are compared as methods for destroying pathogens in liquid sewage sludge. Thermal pasturization is the most effective treatment. Themoradiation destroys viruses, but irradiation is effective except for viruses. Process costs are analyzed and compared. Using conventional accounting and current fuel oil prices, thermal pasturization is the cheapest of the three processes. In general, irradiation is cheaper than thermoradiation. With increases in fuel oil prices, irradiation may become economically more attractive. Presently irradiation is technically feasible but only marginally cost effective. (See also W79-08707) (Small-FRC)
W79-08716

AN ASSESSMENT OF THE MIXING PERFORMANCE OF SEVERAL ANAEROBIC DIGESTERS USING TRACER RESPONSE TECHNIQUES,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
J. Smart.
Research Publication No. 72, 1978. 68 p, 17 fig, 4 tab, 29 ref, 2 append.

Descriptors: *Anaerobic digestion, *Mechanical equipment, *Evaluation, *Design criteria, Performance, Mixing, Efficiencies, Waste water treatment.

The mixing characteristics of a typical modern anaerobic digester were assessed by evaluating ten different digesters. The digesters studied represented extremes in physical size, age, and condition, and included most equipment types currently in use. Digesters tested ranged in size from 754 cu m to 7667 cu m and in specific nameplate power from 654 W/1000 cu m to 6561 W/1000 cu m. Digester mixing ranged from 10% to 89% dead space and averaged about 45% dead space. Four of the seven digesters experienced substrate short-circuiting ranging from 18 to 72% of the sludge substrate input. For all ten digesters, observed hydraulic retention times ranged from 18 to 97% of theoretical values and averaged 65%. No relationships were seen between mixing efficiencies and digester sizes, ages and general conditions, types of mixing equipment installed, and specific applied nameplate power. A review of literature data suggested that digesters were generally overdesigned and indicated that maximum digester volume utilization and elimination of substrate short-circuiting by improved design and mixing efficiencies would permit higher applied organic and hydraulic loadings. (Small-FRC)
W79-08717

DOMESTIC WASTE WATER DISPOSAL AND NUTRIENT REMOVAL BY SEPTIC TANK - SAND FILTER SYSTEM,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
N. A. Chowdhry.
Report 77, 1978. 24 p, 2 fig, 2 tab, 32 ref.

Descriptors: *Filtration, *Septic tanks, *Sewage treatment, *Nitrogen, *Phosphorus, Domestic wastes, Sands, Soil types, Waste water treatment, Costs, Performance.

A septic-tank-sand filter system was tested which contained a naturally occurring mineral, clinoptilolite, and a waste by-product of bauxite purification, red mud, mixed with sand. The efficiency of removal of BOD and suspended solids was more than 96% even after more than one year. There was no significant effect on the efficiency of phosphorus removal with red mud after treatment by the sand-clinoptilolite system. A sand filter containing clinoptilolite can reduce nitrogen content of raw sewage or septic tank effluent by more than 90%. The additional cost for the addition of clinoptilolite to a sand filter serving a four person residence would be approximately $2,000.00 for ten years. Thus, in a location where a conventional tank-tile field can not be installed, a sand filter is an acceptable alternative. If the soil around the sand filter does not contain silt and clay, red mud can be used to retain phosphorus. Clinoptilolite can be added to the filter to remove nitrogen compounds when necessary. (Small-FRC)
W79-08718

NITRIFICATION IN ACTIVATED SLUDGE PLANTS - GUIDELINES ON SOME OPERATION AND DESIGN ASPECTS,
Ontario Ministry of the Environment, Toronto. Wastewater Treatment Section.
A. G. Smith.
Research Publication, W62, 1976. Revised July 1977. 97 p, 17 fig, 12 tab, 66 ref.

Descriptors: *Nitrification, *Activated sludge, *Tertiary treatment, *Denitrification, *Design, Biochemical oxygen demand, Regulation, Monitoring, Trickling filters, Sewage treatment.

A review of the current knowledge on the attainment of nitrification in an activated sludge plant is presented. A literature search was performed, and data is presented from the Ministry of the Environ-

ment's nitrification-denitrification studies. The factors which affect nitrification in the activated sludge process are discussed, and optimum process parameters are proposed. Process monitoring facilities and techniques are reviewed. Waste water treatability studies are discussed to aid in nitrification plant design. New developments include designs of nitrification units which may be used as an add-on tertiary system at existing activated sludge plants treating carbonaceous BOD. These units include trickling filters with recycle or rotating biological discs or drums. An increasing number of wastewater treatment facilities are required to achieve nitrogenous oxidation; thus, new developments in this field are expected. (Small-FRC)
W79-08719

ULTRAVIOLET DISINFECTION OF DOMESTIC SEWAGE AND STORMWATER - A LITERATURE EVALUATION,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
F. A. Tonelli, R. Duff, and B. Wilcox.
Research Paper 2046, 1978. 43 p, 8 fig, 6 tab, 32 ref.

Descriptors: *Ultraviolet radiation, *Waste water treatment, *Disinfection, *Reviews, Chlorination, Municipal wastes, Combined sewers, Overflow.

A literature search was performed to assess the present state-of-the-art of the use of ultraviolet radiation in the treatment of waste water from pollution control plants, combined sewer overflows, and storm sewers. Low pressure mercury vapor lamp UV radiation is capable of adequate and consistent disinfection of waters if substances that absorb or hinder the transmission of radiation are not present. UV irradiation of water does not induce toxicity; however, it can potentially change the mutation rate of microorganisms and induce chemical changes in organic contaminants. UV disinfection appears to be a possible alternative to chlorination of terminal disinfection of secondary or higher quality municipal effluent at smaller plants. This has not yet been proven in full-scale installations. There is almost no data available on UV disinfection of stormwater or combined sewer overflow. (Small-FRC)
W79-08721

HUMAN WASTE DISPOSAL ON BEACHES OF THE COLORADO RIVER IN GRAND CANYON,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
R. A. Phillips, and C. Sartor-Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 733, Price codes: A05 in paper copy, A01 in microfiche. Report CRRP-11, 1977. 79 p, 11 fig, 23 tab, 40 ref.

Descriptors: *Public health, *Coliforms, *Domestic wastes, *Waste disposal, *Waste dumps, Water pollution sources, Recreation facilities, National parks, Beaches.

The potential for public health hazards due to waste burial on beaches, the efficiency of presently used disposal methods, and the feasibility of alternative disposal methods, were investigated for the 20 tons of human waste solids generated by people participating in river trips on the Colorado River. Disposal methods used include burial of the contents of disinfected or untreated holding toilets or dry hole latrines. Fecal coliform levels at the disposal sites in summer were reduced by greater than 99.99% within one month. Low temperatures resulted in lower die-off rates, but few organisms in September dumps survived the winter. The level of fecal coliforms on beach surfaces was generally close to or below the minimum detectable density of 0.02 fecal coliforms/g of sand. Improvements in waste disposal practices are recommended. Visitors should be educated to waste disposal practices and more latrines and holding toilets should be made available. (Small-FRC)
W79-08722

A REVIEW OF PHOSPHORUS REMOVAL TECHNOLOGY,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
R. S. Ryczak, and R. D. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 802, Price codes: A04 in paper copy, A01 in microfiche. Report 7706, 1977. 66 p, 1 fig, 1 tab, 146 ref, 4 append.

Descriptors: *Phosphorus, *Trickling filters, *Lime, *Flocculation, *Permits, Regulation, Tertiary treatment, Waste water treatment, Suspended solids, Biochemical oxygen demand.

Phosphorus removal technology is reviewed for waste water treatment because the National Pollutant Discharge Elimination System requires treatment beyond secondary treatment. Department of the Army treatment facilities are primarily small, trickling filter plants. Chemical-biological treatment can successfully overcome the trickling filter's poor biological phosphorus removal and meet NPDES permit standards. Also, the addition of a chemical step can improve removal of suspended solids, BOD, and COD. Chemical addition can occur in the clarifier. It can also occur in an activated sludge process, although this generally is not done in trickling filter systems. Lime, alum, and iron salts are commonly used in phosphorus reduction. A chemical-biological process can produce phosphorus levels of 1.0 mg/liter total phosphorus. Phosphorus removal technology also includes ion exchange, adsorption, reverse osmosis, and electrochemical techniques. (Small-FRC)
W79-08723

LAND APPLICATION OF SEWAGE SLUDGE BY CONTINUOUS SUBSURFACE INJECTION OPERATION AND ECONOMICS,
National Science Foundation, Washington, DC. Regional Environmental System Div.
J. L. Smith, and C. P. Houck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 135, Price codes: A03 in paper copy, A01 in microfiche. Report NSF/RA-760504, 1976. 40 p, 4 fig, 14 tab, 9 ref, 1 append.

Descriptors: *Sludge disposal, *Land use, *Application methods, *Economics, *Crop production, Ultimate disposal, Land management, Farm equipment, Costs, Stabilization, Treatment facilities, Design, Transportation.

The ultimate disposal of sewage sludge by continuous subsurface injection is discussed. The subsurface injection system developed at Colorado State University is described, and the economics of this method are examined. Important design factors which affect system economics are described and operating information is given. The Colorado State system can apply up to 8% sludge at rates ranging from 20,000 to 80,000 gal/acre/pass. Sludge is supplied to the injector at approximately 700 gpm through a 4 1/8 inch, 660 ft flexible hose. Costs include costs for in-plant sludge stabilization, costs for transporting sludge from the plant to the application site, and costs for land application by subsurface injection. Stabilization represents about 50% of the total annual sludge costs; thus, the sludge stabilization system should be optimized when designing the waste water treatment facility. Transportation cost are not significant until the plant size approaches 30 mgd. Transportation distance is the important factor. The cost of land and cost of land preparation are the major factors influencing the injection system costs. Potential agricultural returns are relatively minor when compared to total system costs. (Small-FRC)
W79-08724

RAPID INFILTRATION OF PRIMARY SEWAGE EFFLUENT AT FORT DEVENS, MASSACHUSETTS,
Army Terrestrial Sciences Center, Hanover, NH.
M. B. Satterwhite, G. L. Stewart, B. J. Condike, and E. Vlach.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 730, Price codes: A03 in paper copy, A01 in microfiche. Report CRREL 76-48, 1976. 34 p, 10 fig, 11 tab, 26 ref, 1 append.

Descriptors: *Sewage treatment, *Infiltration, *Leachate, *Performance, *Groundwater, Leachate, Biochemical oxygen demand, Phosphate, Coliforms, Nitrogen, Municipal wastes.

Rapid infiltration of unchlorinated primary effluent was investigated as a waste water treatment method in northern climates. Treatment of 5049 cu m/day of domestic sewage was accomplished using Imhoff tanks and 22 rapid infiltration treatment beds. Biweekly sampling and analysis of primary sewage effluent and groundwater in 14 observation wells indicated that primary effluent was renovated to an extent comparable to that achieved by conventional tertiary systems. Groundwater COD was 10 to 20 mg/liter and BOD was 1.0 to 2.5 mg/liter. Organic nitrogen and NH4-N were generally less than 4 mg/liter in the groundwater adjacent to the disposal site; effluent concentrations were 11 to 33 mg/liter and 6.2 to 42 mg/liter, respectively for COD and BOD. Total phosphate in the groundwater was 80% less than in the effluent or about 2 mg/liter. Mean chloriform levels in the groundwater were about 200/100 ml, while mean number in the effluent was 32,000,000/100 ml. The treatment beds renovated the primary sewage effluent to levels much better than those achieved with conventional secondary treatment. (Small-FRC)
W79-08725

EVALUATION OF HEALTH EFFECTS ASSOCIATED WITH THE APPLICATION OF WASTEWATER TO LAND,
Southwest Research Inst., San Antonio, TX.
D. E. Johnson, J. W. Register, D. E. Camann, C. H. Millstein, and J. L. Gulinson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 453, Price codes: A06 in paper copy, A01 in microfiche. Report AD-A035 453, 1976. 115 p, 14 fig, 33 tab, 5 ref.

Descriptors: *Monitoring, *Aerosols, *Sprinkler irrigation, *Waste disposal, *Public health, Microorganisms, Viruses, Climates, Sampling, Sewage treatment.

A preliminary environmental monitoring survey was conducted at a secondarily-treated waste water spray irrigation site in Pleasanton, California. The effluent waste water was monitored for inorganic and organic chemical parameters, bacteria, and viruses. The quantities and types of bacteria and viruses in the air around the spray site were also monitored. Recommendations were made regarding further research at the site. At the treatment plant, the residence time of the effluent in the ponds should be investigated. The climatic conditions seem ideal for the study of health effects, but they are not optimum for the study of aerosol transport. Relatively high levels of bacteria were found in air but no pathogenic organisms were located. These results indicate problems in sampling and/or analysis as the results are unrealistic. Many of the upwind samples collected were not indicative of background levels of microorganisms. It is recommended that LEAP and AGI samplers be used. (Small-FRC)
W79-08726

EVALUATION OF REVERSE OSMOSIS FOR ELECTROPLATING WASTES,
Air Force Civil Engineering Center, Kirtland AFB, NM. Water and Solid Resources Div.
D. H. Allen, and E. C. Frein.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 213, Price codes: A03 in paper copy, A01 in microfiche. Report AFCEC-TR-76-42, 1976. 41 p, 9 fig, 4 tab, 13 ref.

Descriptors: *Chromium, *Metallurgy, *Reverse osmosis, *Membranes, *Conservation, Industrial wastes, Waste water treatment, Laboratory tests.

Reverse osmosis was evaluated as a process to reduce pollution and increase materials conservation in large Air Force Chrome plating operations.

Simulated chrome plating solutions were processed by a reverse osmosis unit, and the degree of separation and membrane damage/deterioration was determined. Reverse osmosis was applied to hexavalent chromium in an acidic medium (pH 6.5). Initial tests were made on a tubular, spiral wound, and Permasep membrane to determine which machine was most applicable to the chrome waste stream. The Permasep membrane was chosen for further study. It demonstrated a high salt rejection rate (0.96 to 0.99 reject ratio) and a high product recovery rate (0.59 to 0.70 recovery ratio). A closed system was designed based on the Permasep membrane which resulted in zero discharge of chromium. (Small-FRC)
W79-08727

GAMMA RADIATION TREATMENT OF WATERS FROM LIGNITE MINES,
Central Research and Design Inst. for Opencast Mining, Wroclaw (Poland).
H. Janiak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 802, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/7-79-064, 1979. 103 p, 44 fig, 22 tab, 16 ref, 1 append.

Descriptors: *Gamma rays, *Radiation, *Mine water, *Waste water treatment, *Clays, Suspended solids, Sedimentation rates, Turbidity, Zeta potential, Colloids.

Gamma radiation was investigated for the purification of waters drained from surface lignite mines. The mine water is polluted with various suspended solids usually including clay, and generally has a high oxygen demand and a high iron content. Under laboratory conditions in a radiation chamber, waters containing colloidal suspensions with high zeta potential and turbidity were subjected to gamma radiation. Doses were employed within the limits of 100-2000 kRad with slow dosing of 200 kRad/hour and fast dosing of 800 kRad/hour. A positive influence of Co-60 gamma radiation was seen on the speed of suspended matter sedimentation beginning with an absorbed dose of 500 kRad. The optimal dose was 1000 kRad. The greatest effect in increased clarification occurred with waters having an appreciable COD. Changes in pH and COD of the treated waters were observed suggesting that a chemical and not a physical process influences the colloidal suspension removal because there were simultaneous small changes in the zeta potential. (Small-FRC)
W79-08728

DESIGN AND OPERATION OF AERATED LAGOONS FOR MUNICIPAL WASTEWATER TREATMENT IN COLD CLIMATES,
EKONO Seattle, WA.
H. Edde.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 500, Price codes: A03 in paper copy, A01 in microfiche. Report, 1972. 36 p, 14 fig, 21 ref.

Descriptors: *Winter, *Aerated lagoons, *Design criteria, *Capital costs, Treatment facilities, Heat, Frost protection, Operations.

Experience in the design and operation of aerated lagoons in cold climates is reviewed. Special design precautions to control excessive heat loss to the atmosphere include deeper basins with a minimum of surface area. Influent, cross-over, and effluent lines should be submerged, and aerators often require external heating to prevent icing. One possible alternative is summer aeration but winter chemical treatment. Also, during winter the lower oxygen uptake requirements can be met with an auxiliary external in-line oxygenation device and subsurface mechanical mixing provided to disperse the oxygen and biological solids throughout the basin contents. Cold climate sewage treatment plant design criteria are presented. Capital costs were estimated at .7 million dollars for a less than 1 mgd plant to 8 million dollars for a 100 mgd plant (1972 dollars). (Small-FRC)
W79-08730

CHARACTERIZATION OF NONOILY WASTE WATER ON US ARMY LCU 1561,
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
T. H. Voisinet.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A915 496, Price codes: A03 in paper copy, A01 in microfiche. Report 28-737, 1973. 25 p, 8 fig, 2 tab, 3 ref, 2 append.

Descriptors: *Ships, *Liquid wastes, *Waste water treatment, *Water pollution sources, Domestic wastes, Waste storage, Waste water disposal.

Nonoily liquid wastes generated aboard US Army LCU 1561 during normal deployment, were analyzed. These wastes did not include bilge and ballast water. Waste generation rates, and the physical, chemical, and bacteriological characteristics of the waste water were determined. Twenty-three grab samples of waste water in the port and starboard holding tanks were collected and analyzed. Wastes accumulated at approximately 150 gal per day and had a concentration approximately five times that of typical domestic sewage. Comparisons are made between the characteristics of the port tank (toilet wastes) and the starboard tank (galley wastes). Efficient shore-based management is recommended for waste treatment and disposal. Anaerobic conditions in the tanks should be avoided. (Small-FRC)
W79-08731

DEMINERALIZATION OF CARBON-TREATED SECONDARY EFFLUENT BY SPIRAL-WOUND REVERSE OSMOSIS,
Los Angeles County Sanitation Districts, Whittier, CA.
C. Chen, and R. P. Miele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 197, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-169, 1978. 60 p, 16 fig, 12 tab, 2 ref.

Descriptors: *Reverse osmosis, *Demineralization, *Membranes, *Economics, *Performance, Costs, Maintenance, Hydrogen ion concentration, Effluent streams, Tertiary treatment, Activated carbon, Waste water treatment, Water purification.

A 15,000 gpd spiral-wound reverse osmosis plant was operated on carbon-treated secondary effluent at the Pomona Advanced Wastewater Treatment Research Facility. Effective membrane life was determined, and the reliability of the process was assessed. Also, a realistic estimate of process costs was determined. The first phase of the study was conducted on a constant feed pressure basis. Adjustment of pH was not practiced for the weekly enzyme-detergent membrane cleaning procedures. During the second phase, there was a constant product water flux rate, and pH adjustment was practiced. Both phases substantiated the fact that the membrane effective life was about one year in demineralizing the secondary, carbon-treated effluent. For membranes with a one year life, the process cost for a 10 mgd reverse osmosis plant would be about 14.9 cents/1000 liters. If membranes had a two year life, costs would be reduced to 10.7 cents/1000 liters. These costs do not include the costs of carbon adsorption pretreatment and bine disposal, and are based on 1973 prices. (Small-FRC)
W79-08732

RECOMMENDED DESIGN CRITERIA FOR WASTEWATER TREATMENT AT PROPOSED CONSOLIDATED TACTICAL VEHICLE WASH FACILITY, FORT DRUM, NY,
Construction Engineering Research Lab. (Army), Champaign, IL.
L. Benson, M. Staub, R. Fileccia, and J. Matherly.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 629, Price codes: A04 in paper copy, A01 in microfiche. Report N-26, 1977. 65 p, 27 fig, 4 tab.

Descriptors: *Design criteria, *Oily water, *Filtration, *Settling basins, *Pilot plants, Waste water treatment, Industrial wastes, Regulation, Performance.

To determine design criteria for waste water treatment at a proposed consolidated tactical vehicle wash facility, tracked vehicle washrack discharges were surveyed at Fort Drum, New York. Operation of intermittent sand filters in conjunction with a waste water collection and pretreatment system was monitored to verify waste water compliance with Federal regulations. Pilot scale studies provided data on loading rates, depths and characteristics of filter media, waste removal efficiency, and other pertinent information. Specific design calculations are presented including maximum waste water flow, average flow over washing period, waste water characteristics, and sedimentation basin sizing. The treatment components include a sedimentation basin equipped for mechanical free oil removal followed by a flow equalization basin and intermittent sand filtration. (Small-FRC)
W79-08733

SODA ASH TREATMENT OF NEUTRALIZED MINE DRAINAGE,
Gwin, Dobson and Foreman, Inc., Altoona, PA.
D. A. Long, J. L. Butler, and M. J. Lenkevich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 760, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-090, 1977. 64 p, 15 fig, 11 tab, 13 ref, 2 append.

Descriptors: *Mine water, *Neutralization, *Water softening, *Acidic water, *Mine acids, Waste water treatment, Performance, On-site tests, Iron, Manganese.

The performance of a lime neutralization/soda ash softening process in the treatment of acid mine water was evaluated. The treatment plant located in Altoona, PA, has the capability of treating waters from the Kittanning Run which is acid mine polluted, alone or in combination with waste waters from other sources. The unit process consisted of lime neutralization, aeration, settling, soda ash softening, recarbonation, and filtration. The five month study generally indicated that the desired water quality could be achieved. The coal mine drainage had the characteristics of pH 3.0, acidity 160 mg/liter, iron 14.5 mg/liter, and manganese 4.5 mg/liter. Neutralization of the water resulted in a clarified effluent averaging an 85% reduction in iron. The most effective removal of manganese was by the addition of potassium permanganate to the influent line before neutralization. Effluent quality of 100 mg/liter hardness cost 10 cents/cu m, and treatment to 200 mg/liter hardness cost 9 cents/cu m. (Small-FRC)
W79-08734

POTENTIAL APPLICATIONS OF INSOLUBILIZED ENZYMES IN WASTE TREATMENT,
Princeton Univ., NJ. Dept. of Chemical Engineering.
D. F. Ollis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 481, Price codes: A03 in paper copy, A01 in microfiche. Report NSF-RA-T-73-029, 1973. 24 p, 5 fig, 7 tab, 24 ref.

Descriptors: *Sewage treatment, *Enzymes, *Proteins, *Reviews, Solubility, Biological treatment, Hydrolysis, Food processing industry, Industrial wastes, Sludge treatment.

A brief literature survey is presented which establishes the potential for utilizing covalently insolubilized depolymerases to hydrolyze particulate feed streams in waste treatment. The retention of activity of covalently insolubilized biological molecules toward particulate surfaces is established by work on various substrates. Some potential applications of the system are proposed. Potential applications for these doubly particulate reactor systems may include the solubilization of waste stream particulates to regain nutritional content as, for example, in fish protein hydrolysate production. Another possible application is in the pretreatment of bio-

logical sludge to render filtering and dewatering properties more ideal for subsequent processing. (Small-FRC)
W79-08735

DESIGN CONSIDERATIONS FOR AEROBIC DIGESTERS,
Environmental Protection Agency, Denver, CO. Region VIII.
B. A. Hegg, and K. L. Rakness.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 577, Price codes: A05 in paper copy, A01 in microfiche. Report SA/TSB-8, 1973. 47 p, 1 fig, 7 tab, 7 ref, 2 append.

Descriptors: *Design criteria, *Aerobic treatment, *Digestion, *Oxygen, *Size, Ultimate disposal, Sludge treatment, Equations, Performance.

Design characteristics are summarized for aerobic digesters which will insure satisfactory results. General information is provided on the process including a process description, design factors, advantages, and disadvantages. Unit sizes are considered with a discussion of design factors, the estimation of digester loading, and example calculations. Oxygen requirements are discussed including efficiency considerations, waste sludge, and mode of operation. The removal of supernatant and tank construction are discussed. Parameters on which the design of systems are based include loading rate, solids residence time, process proceeding the digester, and temperature. Sample calculations are presented on sizing a digester based on influent flow, influent BOD, influent TSS, allowable effluent BOD and TSS, and sludge temperature. Oxygen requirements are usually between 1-2 mg/liter and adequate mixing must be provided. Ultimate disposal methods for aerobically digester sludges include drying beds, sludge lagoons, and land application. (Small-FRC)
W79-08736

TECHNICAL ASSISTANCE PROJECT FORT COLLINS WASTEWATER TREATMENT FACILITY FORT COLLINS, COLORADO, JANUARY - FEBRUARY, 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 573, Price codes: A03 in paper copy, A01 in microfiche. Report S and A/TSB - 22, 1973. 25 p, 4 fig.

Descriptors: *Activated sludge, *Evaluations, *Treatment facilities, *Operation and maintenance, Performance, Aeration, Settling basins, Mechanical equipment.

During an operation and maintenance survey of the Fort Collins, Colorado, Wastewater Treatment Plant No. 2, data were collected which indicated that cycles of good quality effluent and poorer quality effluent occurred. Assistance offered by the Environmental Protection Agency caused a series of important physical modifications to be made. All returned sludge was introduced at the head end of each basin. Wasting methods were changed to allow the wasting of smaller amounts of sludge over longer periods of time. Leaky seals in the final clarifier were replaced, and adjustable effluent weirs were put into service to provide flexible oxygen control. A wooden baffle was placed in the collection box at the end of the aeration basins to eliminate excessive turbulence. The return sludge ports in the clarifiers were modified to achieve removal of a uniformly thick return sludge. The modifications minimized the time required to grow and maintain a good activated sludge. (Small-FRC)
W79-08737

UPGRADING EXISTING WASTEWATER TREATMENT PLANTS: CASE HISTORIES.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 446, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-625/4-73-005a, 1973. 31 p, 11 fig, 6 tab.

Descriptors: *On-site tests, *Treatment facilities, *Evaluations, *Activated sludge, *Trickling filters, Aeration, Phosphorus, Odor, Filtration, Chlorination, Flow.

Case histories are presented in which facilities were upgraded through the modification of activated sludge and trickling filter biological processes. Inadequate hydraulic retention or contact time and solids retention time are factors which can limit facility performance. Four case histories are described. The South Buffalo Creek Wastewater Treatment Plant in Greensboro, NC, was upgraded by a project including preaeration, chemical addition for phosphorus removal, special odor-control measures, improved sludge handling, and effluent polishing with deep-bed filters. Suspended solids and BOD removal in excess of 98% are expected. The Livermore Wastewater Treatment Plant in California was upgraded in 1967 and includes preliminary treatment, roughling filters, activated-sludge secondary treatment, and pre- and postchlorination. The plant easily meets standards. The Wards Island Wastewater Treatment Plant in New York, NY, increased capacity to 240 mgd through two plant modifications. The conventional activated-sludge aerators were converted to operate on the step-aeration process, and the flow pattern in the final tanks was changed. A trickling filter plant was upgraded by the addition of activated sludge before filtration. (Small-FRC)
W79-08738

WASTE TREATMENT AND DISPOSAL FROM SEAFOOD PROCESSING PLANTS,
Maryland Univ., Cambridge. Horn Point Environmental Labs.
R. B. Brinsfield, and D. G. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 361, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-157, 1977. 104 p, 38 tab, 16 ref, 11 append.

Descriptors: *Food processing industry, *Shellfish, *Commercial shellfish, *Effluent streams, *Disinfection, Suspended solids, Biochemical oxygen demand, Aerated lagoons, Chlorination, Coliforms, Waste water treatment, Liquid wastes, Industrial wastes.

Current waste water treatment and disinfection practices and effluent characteristics were examined in Maryland seafood processing plants. Randomly selected plants were sampled for effluent from processing of blue crabs, oysters, soft-shell clams, and fish. Effluent was analyzed for settleable solids, total suspended solids, BOD, oil and grease, pH, residual chlorine, phosphorus, nitrate, nitrite, ammonia, total Kjedahl nitrogen, total coliform, and fecal coliform. Oil and grease levels and pH of all the samples met EPA effluent limitations for 1977 and 1983, however, only a few plants were within total suspended solids limits. No plants achieved 1983 BOD limitations and several plants had bacterial levels exceeding standards even with high residual chlorine levels. Alternatives to aerated lagoon treatment of the seafood processing effluent were suggested, such as a compact and relatively inexpensive system of aeration, settling, and chlorination; batch biological treatment; and an inexpensive system of screening, sump pump collection, and chlorination. Disinfection alternatives discussed included ultraviolet radiation, and ozone. (Lisk-FRC)
W79-08739

TRACE ORGANICS VARIATION ACROSS THE WASTEWATER TREATMENT SYSTEM OF A CLASS-B REFINERY,
Argonne National Lab., IL. Energy and Environmental Systems Div.
L. A. Raphaelian, and W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 596, Price codes: A09 in paper copy, A01 in microfiche. Report ANL/WR-78-2, 1978. 183 p, 7 fig, 19 tab, 6 ref, 5 append.

Descriptors: *Oil industry, *Organic compounds, *Activated sludge, *Activated carbon, *Filtration, Industrial wastes, Pilot plants, Flotation, Performance, Waste water treatment.

Effluent from the full-scale treatment system at SOHIO's Toledo refinery was sampled to determine performance of the waste water treatment system. The system consisted of a dissolved air flotation unit and an add-on pilot-scale unit consisting of mixed-media filtration and activated carbon columns. Four-day composites of daily samples were analyzed for common waste water parameters and trace organic compounds using capillary-column gas chromatography/mass spectrometry. About 304 compounds were found in the DAF effluent and removal of these by the activated-sludge clarifier and add-on treatment units was estimated. The activated carbon unit removed non-aromatics better than it did aromatics, while the activated sludge unit was more effective in removing aromatics. Average removal of organics was greater than 99% for activated sludge, about 0% for mixed media filtration, and less than 1% for activated carbon. Of the less than 1% of trace organics remaining in the final clarifier effluent, 81 wt% were removed by activated carbon. (Small-FRC)
W79-08742

DEVELOPMENT OF A SORBENT DISTRIBUTION AND RECOVERY SYSTEM,
Seaward International, Inc., Falls Church, VA.
For primary bibliographic entry see Field 4A
W79-08743

DISPOSAL OF AN INTEGRATED PULP-PAPER MILL EFFLUENT BY IRRIGATION,
Simpson Paper Co., Anderson, CA.
Q. A. Narum, D. P. Mickelson, and N. Roehne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 758, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-79-033, 1979. 133 p, 12 fig, 16 tab, 8 append.

Descriptors: *Irrigation, *Irrigation systems, *Crop production, *Waste water treatment, *Bleaching wastes, Industrial wastes, Waste water disposal, Pulp and paper industry, Leachate, Water quality, California.

The use of fully treated secondary effluent from the Shasta integrated bleached kraft pulp-fine paper mill (Anderson, California), was investigated for beneficial crop irrigation. Laboratory soil columns, field test plots, and hydrological studies were operated. Construction of a 162 hectare irrigation project began in early 1975, and the first effluent irrigation took place in 1976. Wheat, oats, corn, alfalfa, and beans were grown, and crop yields were in most cases better than the California averages for these crops. The effluent percolate eventually enters the Sacramento River. It is essentially devoid of suspended soils, BOD-5, COD, color, and toxic components. Thus, the all effluent discharged meets the requirements of the Waste Discharge Permit issued by a state agency. The primary problem of control of the composition and movement of groundwater was anticipated and required the implementation of a complex monitoring program. (Small-FRC)
W79-08744

COMBINED REVERSE OSMOSIS AND FREEZE CONCENTRATION OF BLEACH PLANT EFFLUENTS,
Institute of Paper Chemistry, Appleton, WI. Environmental Sciences Div.
A. J. Wiley, L. E. Dambruch, P. E. Parker, and H. S. Dugal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 912, Price codes: A08 in paper copy, A01 in microfiche. Report EPA-600/2-78-132, 1978. 156 p, 24 fig, 36 tab, 29 ref, 4 append.

Descriptors: *Pulp and paper industry, *Bleaching wastes, *Waste water treatment, *Reverse osmosis, *Freezing, Performance, Recycling, Costs, Water quality

Reverse osmosis and freeze concentration were evaluated as methods for concentrating bleach plant effluent at three pulp and paper mills. These concentration processes divided the feed effluent into two streams. The clean stream approached drinking water purity in some instances and could be recycled to the mill without serious problems. Virtually all of the dissolved material was present in the concentrate stream. Generally, reverse osmosis removed 90% of the water from a stream containing 5 g/liter of total solids to yield a concentrated stream with 50 g/liter solids. The reverse osmosis concentrate was further concentrated by freezing to about 200 g/liter. Thus, each 100 liters of feed resulted in about 2 liters of waste concentrate and 98 liters of relatively clean water. Ultimate disposal of the waste concentrate was not investigated. Economics were estimated based on data from the three mills. Reverse osmosis alone or in combination with freeze concentration is expensive. Costs range from $18 to $27/metric ton of bleached pulp. When fresh water usage was reduced, membrane life was increased and costs were lowered. (Small-FRC)
W79-08745

WASTEWATER DEMINERALIZATION BY CONTINUOUS COUNTER-CURRENT ION EXCHANGE PROCESS,
Los Angeles County Sanitation Districts, Whittier, CA.
C. Chen, and R. P. Miele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 301, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-77-152, 1977. 47 p, 5 fig, 8 tab, 6 ref, 2 append.

Descriptors: *Ion exchange, *Pilot plants, *Demineralization, *Cation exchange, Anions, *Resins, Continuous flow, Dissolved solids, Brines, Costs, Separation techniques, Waste water treatment, Municipal wastes.

A 10 gpm pilot plant, manufactured by Chemical Separation Corporation of Tennessee, was operated in Pomona, California for the demineralization of waste water by continuous counter-current ion exchange. At a total organic solid feed rate of 500-600 mg/liter under steady state conditions the pilot plant achieved 82% total dissolved solids removal. The total dissolved solids removal rate decreased to below that achieved in a two-stage fixed-bed system when the use of an inadayne rinse caused leakage of monovalent cations. Regeneration efficiency for the cation and anion exchangers appeared good in the ion exchange pilot plant. The process generated a brine volume which was about 8% of the product flow and thus achieved a 92% water recovery. Resin losses were approximately 5% for the cation exchanger and about 15% for the anion exchanger, annually; however, these losses represented less than 5% of the total process cost. For a 10 mgd continuous counter-current ion exchange plant based on the pilot plant results and utilizing carbon treated secondary effluent with an average of 600 mg/liter total dissolved solids, the total cost would be about $.048/1000 gal and the removal efficiency would be about 82%. (Lisk-FRC)
W79-08750

TOTAL ENERGY CONSUMPTION FOR MUNICIPAL WASTEWATER TREATMENT,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
R. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 688, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-149, 1978. 43 p, 7 fig, 8 tab, 25 ref.

Descriptors: *Energy, *Conservation, *Waste water treatment, *Treatment facilities, Construction, Energy budget, Energy conversion, Incineration, Anaerobic digestion, Electric power, Municipal wastes.

The quantities of different forms of energy consumed for the collection and treatment of municipal waste water are estimated. A conversion factor of 10,500 Btu/kwh is used to convert heat energy to electrical energy. Total energy consumption ranges from 2300-3700 kwh/mg of waste water treated. Energy used for treatment plant construction and sewerage system construction represents 35 to 55% of the total energy consumed. Energy used for plant operation (65-75%) is predominately electrical. Energy can be conserved during plant operation with the use of highly efficienct aeration devices combined with good maintenance practices. Energy can be recovered from the sludge produced at the plant by anaerobically digesting the sludge and using the digester gas as fuel for the internal combustion engine. Large plants with sufficiently dewatered sludge can recover energy by incineration of the dewatered sludge to produce steam in a waste heat boiler. The steam can then be used as an energy source throughout the plant. (Small-FRC)
W79-08751

UNOX DESIGN INFORMATION FOR CONTRACT DOCUMENTS,
Metcalf and Eddy, Inc., New York.
A. A. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 385, Price codes: A02 in paper copy, A01 in microfiche. Report, 1972. 22 p, 5 fig.

Descriptors: *Activated sludge, *Design criteria, *Oxygen, *Waste water treatment, *Oxidation, Performance, Pilot plants, Costs, Treatment facilities.

The Unox activated sludge process is described which uses gaseous oxygen rather than air to maintain dissolved oxygen in the mixed liquor. This process can meet a much higher mixed liquor oxygen demand than any aerated modification, and can meet the demands of higher BOD loadings in the oxidation tanks. Using a pilot plant at the Middlesex County Sewerage Authority as an example, design data are presented for the oxygenation tanks, final settling tanks, and the cryogenic oxygen process. PSA oxygen generators and oxygen storage facilities are described. Safety precautions are reviewed for pure oxygen use. The use of the Unox process is expected to save about 15% in project costs and annual costs. (Small-FRC)
W79-08752

THE COST OF COLUMNAR DENITRIFICATION FOR REMOVAL OF NITROGEN FROM WASTEWATER,
National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab.
R. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 944, Price codes: A03 in paper copy, A01 in microfiche. Report, 1972. 44 p, 10 fig, 13 tab, 5 ref.

Descriptors: *Denitrification, *Effluent streams, *Design criteria, *Capital costs, *Operating costs, Treatment facilities, Activated sludge.

The practicability and cost of columnar denitrification of secondary effluent were investigated. Design criteria are presented for pressure vessels, pressure vessel piping and controls, pumping facilities, and methanol feeding and storage. A detailed cost estimate is made. Columnar denitrification is somewhat more expensive than dispersed floc, but developments in fabrication and design could lead to reductions. Operating and maintenance costs for columnar denitrification are estimated at $997,658 per year for a 100 mgd plant, and total capital costs for denitrification in dispersed floc basins downstream of the activated sludge process for a 100 mgd plant is $4,812,811. These estimates are in 1971 dollars. (Small-FRC)
W79-08753

NITRIFICATION OF SECONDARY MUNICIPAL WASTE EFFLUENTS BY ROTATING BIODISCS,
Michigan Univ., Ann Arbor.
J. A. Borchardt, S. J. Kang, and T. H. Chung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 240, Price codes: A08 in paper copy, A01 in microfiche. Report EPA-600/2-78-061, 1978. 138 p, 28 fig, 22 tab, 71 ref, 4 append.

Descriptors: *Nitrification, *Effluent streams, *Trickling filters, *Sewage lagoons, *Biological treatment, Performance, Nitrogen, Ammonia, Nitrates, Pilot plants.

The biological nitrification of two municipal waste plant effluents was studied. The effluents were from a high-rate trickling filter or a flow-through, two-stage, raw sewage lagoon. Both effluents contained nitrogen compounds in the form of organic nitrogen, ammonia, and more oxidized forms including nitrate. Two rotating bio-disc pilot units were designed and added to the effluent end of the two municipal waste plants. Operation of the pilot units was monitored for nitrification efficiency. The high-rate trickling filter effluent results were promising, and the design of an optimum nitrification system is discussed considering pH, alkalinity, loading, staging, and other factors. Attempts to investigate the municipal flow-through lagoon met with problems caused by insufficient ammonia nitrogen and inclement weather. This part of the research was cancelled. (Small-FRC)
W79-08754

BREAKPOINT CHLORINATION ACTIVATED CARBON TREATMENT: EFFECT ON VOLATILE HALOGENATED ORGANICS,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
J. J. Westerick, M. D. Cummins, and J. M. Cohen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 129, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-78-165, 1978. 78 p, 26 fig, 15 tab, 43 ref, 1 append.

Descriptors: *Pilot plants, *Chlorination, *Halogens, *Activated carbon, *Effluent streams, Tertiary treatment, Adsorption, Water purification, Separation techniques.

A continuous-flow pilot plant was used to monitor the production of six volatile halogenated organic compounds during breakpoint chlorination of wastewater for ammonia removal and to determine the efficiency of removal of these compounds by activated carbon. Lime-clarified and filtered trickling filter effluent were treated by chlorination/activated carbon systems. The first chlorination system was located before a two-stage carbon adsorber, and the second was between stages of a second two-stage adsorber. The chloroform concentration was increased from a meidan value of 11 micrograms per liter in the tertiary filter effluent to a median value of 61 micrograms/liter with chlorination. Chloroform production in the chlorination system located after one stage of carbon produced one fourth as much chloroform. Bromodichloromethane was formed in amounts less than 10 micrograms/liter when the filter effluent was chlorinated. Chlorination of the first stage carbon effluent produced lower concentrations of bromodichloromethane during the first month of operation, but later these levels were equal to or greater than those produced by chlorination of the filter effluent. Only very low concentrations of dibromochloromethane, bromoform, carbon tetrachloride, and 1,2-dichloroethane were formed. Chloroform removal was more efficient with a 20 minute empty bed contact time absorber than with a 10 minute contact time absorber, probably because of competitive effects of more strongly adsorbed organics. (Small-FRC)
W79-08755

AUTOTROPHIC DENITRIFICATION USING SULFUR ELECTRON DONORS,
Cornell Univ., Ithaca, NY.
A. W. Lawrence, J. J. Bisogni, B. Batchelor, and C. T. Driscoll.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 345,

Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-78-113, 1978. 112 p, 24 fig, 28 tab, 76 ref, 2 append.

Descriptors: *Denitrification, *Municipal wastes, *Nitrates, *Laboratory tests, *Kinetics, Energy, Sulfur, Performance, Continuous flow, Non-uniform flow, Packed beds.

Autotrophic denitrification was investigated as a nitrate removal process for municipal waste water. The microbial kinetics were evaluated, and the process performance of autotrophic microbially mediated denitrification using sulfur electron donors was assessed. In the first experimental phase with continuous flow, slurry type reactors, with elemental sulfur as the electron source, greater than 99.5% nitrate removal was achieved at steady state. In the second experimental phase employing semi-continuous flow reactors with thiosulfate or sulfide as electron donors reliable autotrophic denitrification was obtained. The consumptive ratio for these systems was close to 1.35. In the final experimental phase, packed bed columnar autotrophic denitrification was investigated. Autotrophic denitrification was possible using elemental sulfur as an electron source. Autotrophic denitrification appears to be a feasible process, but it should be investigated on pilot scale. (Small-FRC)
W79-08756

TREATMENT OF WASTEWATERS FROM ADHESIVES AND SEALANTS MANUFACTURE BY ULTRAFILTRATION,
Abcor, Inc., Wilmington, MA. Walden Div.
M. H. Kleper, R. L. Goldsmith, T. V. Tran, D. H. Steiner, and J. Pecevich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 498, Price codes: A12 in paper copy, A01 in microfiche. Report EPA-600/2-78-179, 1978. 121 p, 15 fig, 39 tab, 13 ref.

Descriptors: *Industrial wastes, *Filtration, *On-site investigations, *Separation techniques, *Adhesives, Sealants, Waste water treatment, Municipal wastes, Performance, Design criteria.

A demonstration project is described for the treatment of effluents from adhesives and sealants manufacture to produce water suitable for discharge into municipal sewers. A seven-month field demonstration was performed at the Dewey and Almy Chemical Divison of W. R. Grace and Company in San Leandro, California. Also, preliminary studies were performed of ultrafiltration permeate post-treatment alternatives, full-scale ultrafiltration performance was documented at a Chicago plant, and full-scale treatment system designs and economic projections were developed for plants with waste water flows ranging from 3.8 cu m/day to 75.8 cu m/day. Ultrafiltration was a viable process for separating adhesives and sealants manufacturing waste waters into low-volume and high-volume streams. The permeate had the following average contaminant loadings: 100 mg/liter total freon extractibles, less than 7.4 mg/liter nonpolar extractibles, less than 27 mg/liter suspended solids, 0.43 mg/liter free cyanide, 3.6 mg/liter total cyanide, 8900 mg/liter BOD, 36,600 mg/liter COD, 44.6 mg/liter phenolic compounds, and 1.5 mg/liter zinc. This effluent is acceptable for discharge into municipal sewers except for phenolic compound and cyanide levels. An ultrafiltration system with ozonation or reverse osmosis is proposed to meet all municipal discharge standards. (Small-FRC)
W79-08758

REMOVAL OF TOXIC METALS FROM METAL FINISHING WASTEWATER BY SOLVENT EXTRACTION,
Texas Southern Univ., Houston.
C. W. McDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 563, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-600/2-78-011, 1978. 16 p, 3 tab, 14 ref.

Descriptors: *Industrial wastes, *Metals, *Solvent extractions, +Metallurgy, Chromium, Cadmium, Zinc, Performance, Waste water treatment, Separation techniques.

High molecular weight Alamine 336 was used to remove chromium, cadmium, copper, nickel, and zinc from metal finishing waste water. The extraction of the metals ions was studied using synthetic solutions and actual finishing waste water samples. Using a 100 to 1 waste water to Alamine-336-xylene solution, chromium, cadmium, and zinc ions were extracted simultaneously and selectively. Copper and nickel were not satisfactorily extracted. Chromium, cadmium, and zinc can be stripped from the organic phase with better than 99.5% efficiency using 4 M NaOH. When the reagent is regenerated and recycled, there is no loss of extraction efficiency. The procedures are rapid, reproducible, and relatively efficient. The high molecular weight amines such as Alamine-336, Aliquat-336-S, Primene JMT, Primene 81R, and Amberlite LA1 were unsatisfactory as extractants. The simultaneous extraction of chromium, cadmium, and zinc may have some promise for adoption on an industrial scale. (Small-FRC)
W79-08759

OPERATIONAL RESULTS FOR THE PISCATAWAY MODEL 5 MGD AWT PLANT,
Environmental Protection Agency, Washington, DC. Office of Air and Water Programs.
T. P. O'Farrell, and R. A. Menke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 162, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-172, 1978. 92 p, 21 fig, 51 tab, 1 append.

Descriptors: *Tertiary treatment, *Lime, *Filtration, *Activated carbon, *Treatment facilities, Performance, Biochemical oxygen demand, Suspended solids, Phosphorus, Nitrogen, Operating costs, Personnel.

The operation of a 5 mgd tertiary waste water treatment demonstration plant used to upgrade the quality of effluent from a conventional secondary plant is discussed. The tertiary plant used either two-stage high lime or single-stage low lime followed by dual-media filtration and granular activated carbon adsorption. The high lime process significantly reduced residuals of BOD, TSS, and phosphorus in the secondary effluent using an average dosage of 257 mg/liter CaO and 18 mg/liter FeCl3. The low lime process produced similar removal of residuals using an average does of 113 mg/liter CaO and 25 mg/liter FeCl3. Tertiary treatment did not affect total nitrogen residuals. Regeneration of the tree columns under less than optimum conditions resulted in carbon losses estimated at 8 to 10%. The tertiary treatment demonstration plant had operating costs which ranged from 29 to 36 cents per 1000 gal. Since these costs were obtained during start-up, they are probably unusually high. Efforts to select, train, and maintain a highly competent staff are recommended for optimum plant operation. (Small-FRC)
W79-08760

WATER FACTORY 21: RECLAIMED WATER, VOLATILE ORGANICS, VIRUS, AND TREATMENT PERFORMANCE,
Stanford Univ., CA. Dept. of Civil Engineering.
P. L. McCarty, M. Reinhard, C. Dolce, H. Nguyen, and D. G. Argo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 053, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-78-076, 1978. 88 p, 11 fig, 31 tab, 16 ref, 2 append.

Descriptors: *Municipal wastes, *Lime, *Chlorination, *Activated carbon, Filtration, *Reverse osmosis, Performance, Organic compounds, Metals, Biochemical oxygen demand, Phosphate, Ammonia, Nitrogen, Viruses, Halogens.

The first one and one-half years of operation of the Water Factory 21, a 0.66 cu m/sec (15 mgd) advanced waste water treatment plant designed to improve the quality of biologically treated municipal waste water so that it can provide injection water for a seawater barrier system, is described. Processes utilized include lime treatment, ammonia stripping, breakpoint chlorination, filtration, activated-carbon adsorption, reverse osmosis, and final chlorination. The effluent quality was evaluated, and the efficiency of treatment for inorganic, organic, and biological contaminants was determined. Chemical clarification with lime at pH greater than 11.3 removed 60% of COD, 99% of phosphate, and more than 50% of most metals. Ammonia stripping averaged 82% removal of ammonia and reduced the concentrations of low molecular weight and non-polar organics. General COD removal was effected by activated carbon adsorption as was removal of a wide range of organic compounds. Breakpoint chlorination reduced ammonia nitrogen to 1 mg/liter, but resulted in the formation of halocarbons. Reverse osmosis removed 95% of general inorganics and 93% COD. Only one case of virus was found in the effluent. It was associated with an occasional problem of activated carbon fines in the effluent. (Small-FRC)
W79-08761

TWO-STAGE GRANULAR ACTIVATED CARBON TREATMENT,
Los Angeles County Sanitation District, Whittier, CA.
L. S. Directo, C. Chen, and R. P. Miele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 438, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-170, 1978. 64 p, 24 fig, 17 tab, 11 ref.

Descriptors: *Activated carbon, *Adsorption, *Tertiary treatment, *Performance, *Costs, Maintenance, Operating costs, Efficiencies, Filtration, Separation techniques.

The effect of repeated thermal regeneration cycles on the adsorption capacity, regeneration loss, and pressure drop buildup of carbon with different particle size was evaluated. Two 6.3 liter/sec (0.15 mgd), two-stage, packed-bed, downflow granular activated carbon plants were operated continuously for 33 months using activated sludge plant effluent which was unfiltered and unchlorinated. For the Filtrasorb 300 system, the average effluent dissolved chemical oxygen demand was 6.4 mg/liter and the average suspended solids concentration was 2.1 mg/liter. These values for the Filtrasorb 400 system were 6.2 mg/liter and 2.0 mg/liter, respectively. The carbon capacity in the Filtrasorb 300 system decreased about 25% after four absorption cycles which resulted in an apparent steady state capacity of 0.25 lbs COD removed carbon. After three adsorption cycles in the Filtrasorb 400 system, a 23% decrease in carbon capacity occurred. The 300 system showed slightly less carbon capacity that the 400 system, but has lower initial cost, lower pressure loss, and lower regeneration loss. The estimated total treatment cost for a .044 cu m/sec (10 mgd), two-stage carbon adsorption 300 system was 11.52 cents/1000 gal. (Small-FRC)
W79-08762

PROCESS DESIGN MANUAL FOR NITROGEN CONTROL,
Brown and Caldwell Walnut Creek, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 149, Price codes: A19 in paper copy, A01 in microfiche. Report EPA/625/1-75/007, 1975. 457 p, 129 fig, 91 tab, 419 ref, 2 append.

Descriptors: *Nitrification, *Denitrification, *Treatment facilities, Publications, *Chlorination, Ion exchange, Design criteria, Waste water treatment, Municipal wastes.

A design manual was compiled for providing process design criteria for implementing nitrogen control in municipal waste water treatment plants. Data from pilot plant and full-scale installations were used to develop design concepts for the technology. The manual contains design criteria for biological nitrification and denitrification, breakpoint chlorination, ion exchange, and air

stripping. The incorporation of various unit processes into a rational treatment design is described. Case studies of actual treatment systems which instituted nitrogen control processes are detailed. (Lisk-FRC)
W79-08763

WASTEWATER MANAGEMENT FOR NEW HOUSING DEVELOPMENT. ADVANCED WASTEWATER TREATMENT TECHNIQUES AND NEW EQUIPMENT.
SCS Engineers, Long Beach, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 778, Price codes: A04 in paper copy, A01 in microfiche. Report HUD/RES-1321, 1977. 46 p, 5 fig, 4 tab, 43 ref, 1 append.

Descriptors: *Electrodialysis, *Reverse osmosis, *Filtration, *Chlorination, *Activated carbon, Ozone, Nitrification, Ion exchange, Performance, Costs, Waste water treatment.

The current state of development of ten potential advanced waste water treatment processes is discussed. These include electrodialysis, reverse osmosis, ozonation, microscreening, multi-media filtration, powdered activated carbon, breakpoint chlorination, selective ion exchange, nitrification, and denitrification. Electrodialysis and reverse osmosis are for the removal of dissolved inorganic solids. They are expensive and have membrane fouling problems. Microscreening and multi-media filtration are in limited use to reduce suspended solids. Air-stripping, breakpoint chlorination, selective ion exchange, and nitrification are proven technologies. Ozonation and powdered activated carbon are proven effective and cost competitive. All systems have higher capital and operating costs but have potential for meeting current or proposed stringent effluent quality standards. (Small-FRC)
W79-08765

WASTEWATER MANAGEMENT FOR NEW HOUSING DEVELOPMENT TREATMENT AND DISPOSAL ALTERNATIVES FOR DOMESTIC SEWAGE MANAGEMENT.
SCS Engineers, Long Beach, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 777, Price codes: A06 in paper copy, A01 in microfiche. Report HUD/RES-1319, 1977. 24 p, 13 fig, 4 tab, 3 append.

Descriptors: *Domestic wastes, *Waste water treatment, *Sewage disposal, *Sewage treatment, Tertiary treatment, Planning, Performance.

The basic characteristics and volume generation data for domestic sewage are considered in this part of a series on Wastewater Management for New Housing Development. The mechanics of conventional primary, secondary, and tertiary sewage treatment processes are described. Ultimate disposal alternatives are discussed with emphasis on disposal techniques, effluent qualities and required treatments, and typical regulations associated with each disposal method. Discharge into surface waters, land application, and waste water reuse are considered. The overall capabilities of sewage treatment and disposal alternatives are summarized considering pollutant removals, operational requirements, and reliability. Any of the treatment sequences discussed can be designed for any flow volume, and, with proper maintenance, the life of the system is 20-25 years. (Small-FRC)
W79-08766

WASTEWATER MANAGEMENT FOR NEW HOUSING DEVELOPMENT COMPARATIVE EVALUATION OF THE PERFORMANCE OF PACKAGE WASTEWATER TREATMENT SYSTEMS.
SCS Engineers, Long Beach, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 779, Price codes: A05 in paper copy, A01 in microfiche. Report HUD/RES/1322, 1977. 82 p, 27 fig, 13 tab, 1 append.

Descriptors: *Treatment facilities, *Mechanical equipment, *Activated sludge, *Trickling filters, Filtration, Adsorption, Costs, Performance, Planning.

A summary of available package waste water treatment equipment is presented along with a discussion of the selection and analysis of optimum conceptual treatment systems. This report is part of a series on Waste Management for New Housing Development. Package plant treatment processes include activated sludge type, trickling filtration and activated sludge, rotating media (Biodisc), and physical/chemical. Tertiary options such as filtration and carbon adsorption are also described. The treatment types are classified to aid contractors in the selection of the best process. For each optimum treatment system, a process flow diagram is included together with a summary of anticipated capital, operational, and maintenance costs. In this section, systems are considered which may not be available as a package plant. (Small-FRC)
W79-08767

NITRIFICATION AND DENITRIFICATION FACILITIES: WASTEWATER TREATMENT.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 447, Price codes: A03 in paper copy, A01 in microfiche. Report EPA/625/4-73/004a, 1973. 34 p, 23 fig, 3 tab, 13 ref.

Descriptors: *Nitrification, *Denitrification, *Waste water treatment, *Kinetics, Mechanical equipment, Treatment facilities, Design criteria.

Nitrification and denitrification in waste water treatment are described and discussed. Factors affecting nitrification kinetics are considered including nitrification population dynamics and oxygen nitrification systems. Investigations of nitrification kinetics are reviewed. Design criteria for nitrification systems are described including nitrification tanks and settling tanks. Denitrification by suspended growth systems is considered in discussions of nitrification tanks, settling tanks, and sludge. (Small-FRC)
W79-08768

EVALUATION OF THE EFFECTIVENESS OF CHLORINATION AT THE LITTLETON WASTEWATER TREATMENT PLANT, LITTLETON, COLORADO, MAY 15-23, 1972.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 881, Price codes: A03 in paper copy, A01 in microfiche. Report S and A/TSB-3, 1972. 26 p, 8 fig, 3 tab, 2 ref, 2 append.

Descriptors: *Chlorination, *Evaluation, *Coliforms, *Water quality, *Chlorine, Rivers, Water pollution sources, Disinfection.

A study was made at the Littleton, Colorado waste water treatment plant of the effectiveness of chlorination in providing satisfactory disinfection before discharge to the South Platte River. Chlorine residuals downstream from the Littleton outfall were also evaluated. The average daily flow was 4.25 mgd and the length of chlorine contact time was 18 min. The chlorine dosage was adjusted from 3.41 mg/liter to 7.45 mg/liter to determine the effect of various dosages on fecal coliform concentrations at the outfall. Chlorine residuals increased at the outfall and in the river as the chlorine dosage increased, except at breakpoint chlorination which occurred at a dosage of about 5.0 mg/liter. The total fecal coliform concentration at the outfall varied inversely with the chlorine residual at the outfall. Dosages of about 5.0 mg/liter yielded the highest total and fecal coliform concentrations. Under usual conditions at Littleton, the chlorine dosage required to reach the 100 fecal coliform per 100 ml concentration is about 4.64 mg/liter. A chlorine dosage this high would increase chlorine residual in the river to about 0.1 mg/liter which would be detrimental to fish. A better solution would be to increase chlorine contact time. (Small-FRC)
W79-08770

TECHNICAL ASSISTANCE PROJECT LONGMONT WASTEWATER TREATMENT FACILITY, LONGMONT, COLORADO, MARCH-MAY 1972.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 569, Price codes: A03 in paper copy, A01 in microfiche. Report S and A/TSB-2, 1972. 24 p, 10 fig.

Descriptors: *Activated sludge, *Filtration, *Waste water treatment, *Treatment facilities, *Evaluations, Biochemical oxygen demand, Municipal wastes, Sludge treatment, Standards.

An operational assistance program was initiated to improve the quality of effluent from the treatment plant in Longmont, Colorado. Through operational changes and control, the effluent BOD concentration was reduced from 70 mg/liter to 50-55 mg/liter. This is not a satisfactory effluent level, and the main limiting factors on the activated biofilter unit were lack of sufficient contact time of the redwood media, lack of variable return mixed liquor flow, and the large final clarifier. Major plant modifications are necessary to meet the effluent standard of 80% BOD reduction. Until modifications can be made, operational guidelines are recommended. Flow adjustments should be made between the two filters to determine optimum flow. Raw sludge should not be centrifuged. Supernatant should not be returned to the head of the plant until a supernatant layer can be developed. Digested sludge should be centrifuged or drawn into sludge drying beds. Analysis of all plant functions should continue. (Small-FRC)
W79-08771

UPGRADING LAGOONS.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 974, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-625/4-73-001a, 1973. 50 p, 20 fig, 10 tab, 27 ref.

Descriptors: *Sewage lagoons, *Design characteristics, *Performance, *Treatment facilities, Dikes, Algae, Biochemical oxygen demand, Maintenance, Operations.

Techniques for upgrading lagoons used in waste water treatment are described, and three case studies are presented. Types of lagoons are described, and operating problems are discussed. A well-designed lagoon will incorporate physical features that minimize upsets, maintenance, and odor problems, and maximize operational flexibility, stability, and BOD removal. These features can be added to existing lagoons to upgrade their performance. Favorable design features include configuration, recirculation, feed and withdrawal variations, pond transfer inlets and outlets, dike construction, supplementation of oxidation capacity, and algae removal. The three cases histories include design characteristics, operating data, and cost data. The systems are located in Sunnyvale, California; Los Banos, California; and Stockton, California. (Small-FRC)
W79-08772

EVALUATION OF LEACHATE TREATMENT VOLUME I. CHARACTERIZATION OF LEACHATE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W79-08774

SEPARATION OF ALGAL CELLS FROM WASTEWATER LAGOONS EFFLUENTS VOLUME I: INTERMITTENT SAND FILTRATION TO UPGRADE WASTE STABILIZATION LAGOON EFFLUENT,

Utah Water Research Lab., Logan.
S. E. Harris, D. S. Filip, J. H. Reynolds, and E. J. Middlebrooks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 925, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-78-033, 1978. 168 p, 31 fig, 11 tab, 55 ref, 4 append.

Descriptors: *Filtration, *Sands, *Intermittent streams, *Algae, *Performance, *Regulation, Biochemical oxygen demand, Suspended solids, Nitrogen, Hydrogen ion concentration, Flow rates.

The performance characteristics of the intermittent sand filter for polishing lagoon effluent were evaluated. It was determined if filter effluent could consistently meet the requirements of PL 92-500. Effluent meet the stringent water quality standards, but effluent quality was affected by temperature and hydraulic loading rate variations. Effluent values of less than 10 mg/liter BOD, 10 mg/liter suspended solids, and 5 mg/liter volatile suspended solids were met. Within the filters, organic nitrogen conversion and excellent nitrification took place. Effluent had a nitrite-nitrogen concentration less than 0.10 mg/liter and a pH from 7.1 to 8.5. In general, dissolved oxygen was reduced, and all algal genera were removed by filters with a 0.17 mm effective size filter sand. Intermittent sand filter hydraulic loading rates ranging from 3742 to 5613 cu m/ha.d (0.4 to 0.6 million gal/acre/day) should achieve a high effluent quality, maximum total mass of pollutants removed, and a practical filter run length. (Small-FRC)
W79-08775

ADVANCES IN TREATMENT OF DOMESTIC WASTES.
Environmental Protection Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 604, Price codes: A11 in paper copy, A01 in microfiche. Report, 1972. 246 p, 83 fig, 54 tab, 84 ref.

Descriptors: *Training, *Personnel, *Domestic wastes, *Waste water treatment, Operations, Coagulation, Activated carbon, Ion exchange, Electrodialysis, Reverse osmosis, Filtration, Aeration.

This is a training manual for courses offered to administrative, professional, and technical personnel involved with the selection, design, and operation of waste water treatment upgrading operations. It is prepared for the reference use of students. Current status and trends in waste water treatment are reviewed in a series of six articles. There are eight articles on the basic principles of unit processes. Improving conventional plant performance is dealt with in nine articles. Basic processes considered include coagulation, carbon adsorption, ion exchange, electrodialysis, reverse osmosis, in-depth filtration, microstraining, and aeration. Sludge disposal by landspreading, and combined industrial domestic treatment for paper mills are two specific topics that are discussed. (Small-FRC)
W79-08776

MERL REPORT OF PROGRESS, 1978.
Municipal Environmental Research Lab., Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 508, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/9-79-009, 1978. 83 p, 32 fig, 235 ref.

Descriptors: *Laboratories, *Projects, *Research and development, *Waste water treatment, Water treatment, Solid wastes, Dewatering, Costs, Oxidation, Federal government.

This progress report provides up-to-date information about the programs of the Municipal Environmental Research Laboratory. The laboratory is the Environmental Protection Agency's research component for the development of technology, systems, and processes to control and prevent environmental pollution. Three research divisions are represented: solid and hazardous, waste water, and drinking water. The waste water research division has performed recent work in sludge dewatering. It was found in pilot plant studies that various modes of filter press operation can produce dewatered sludge suitable for incineration at quite advantageous unit costs and with annual savings of millions of dollars. The operation of a new biological treatment method, the deep shaft process, is discussed. Waste water flows into and out of a shaft that can be hundreds of meters deep to produce high oxygen levels at the bottom. This is a high-intensity, high-rate treatment process with reduced sludge production. A third research area in waste water is the concept of treatability of hazardous compounds. Treatability studies consider the molecular characteristics of the compound and remove specific compounds by adsorption, biodegradation, and chemical modification. (Small-FRC)
W79-08777

MANPOWER ANALYSIS: MUNICIPAL WASTEWATER TREATMENT FACILITIES IN NEW ENGLAND,
E. B. Gendel, H. N. Kessel, B. F. Kincannon, R. A. Rosenthal, and A. Lazeroff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 305, Price codes: A10 in paper copy, A01 in microfiche. Report, 1972. 192 p, 51 tab, 7 ref.

Descriptors: *Manpower, *Employment opportunities, *Education, *New England, *Surveys.

Six New England states were surveyed in this manpower analysis of waste water treatment plants made in the summer of 1972. Plant site visits were used to obtain universal coverage of municipal plants in Connecituct, Massachusetts, Rhode Island, Maine, Vermont, and New Hampshire. A questionnaire was devised and used to gather information on existing and future manpower needs in the industry. Information is provided on current job vacancies, separations, New England manpower totals, percentage of civil service workers, percentage of union members, level of education of employees, length of service of employees, percentage of certified workers, earnings, and manpower projections. 1977 manpower projections are given by state. Data on the number and type of training courses available to the operators was also compiled. (Small-FRC)
W79-08778

TECHNICAL ASSISTANCE PROJECT VAIL WASTEWATER TREATMENT FACILITY VAIL, COLORADO, MARCH - APRIL 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 257, Price codes: A03 in paper copy, A01 in microfiche Report SA/TSB-21, 1973. 31 p, 4 fig, 2 ref.

Descriptors: *Treatment facilities, *Evaluations, *Biochemical oxygen demand, *Sampling, *On-site tests, Activated sludge, Aeration, Training, Waste water treatment, Performance, Suspended solids.

The Environmental Protection Agency evaluation of the Vail, Colorado, waste water treatment facility is discussed. Various plant deficiencies were observed and initial modifications were made. During a period of technical assistance, plant personnel were taught the proper techniques used in collecting, compositing, and storing waste water samples for BOD-5 and suspended solids and were given instruction in the testing procedures. Prior to technical assistance, the facility was operated with the major emphasis on eliminating sludge bulking. Little sludge bulking occurred but effluent quality was not satisfactory. Modifications were made including the conversion from the contact stabilization mode to the conventional mode of activated sludge operation and the initiation of continuous aerator operation. Other deficiencies were corrected by removing the baffles from the final clarifiers, by changing the location for withdrawing waste or excess activated sludge, and by adjustment and cleaning of the polymer feed equipment. The combination of modifications reduced the clarifier effluent BOD-5 from 110 mg/liter to 45 mg/liter during assistance and to about 30 mg/liter after assistance was completed. Problems with the secondary clarifier prevented the facility from meeting the BOD-5 standard consistently. (Small-FRC)
W79-08779

WASTE MANAGEMENT OPERATIONS, SAVANNAH RIVER PLANT, AIKEN, SOUTH CAROLINA.
Department of Energy, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-08780

3RD USA/USSR SYMPOSIUM ON INTENSIFICATION OF BIO-CHEMICAL TREATMENT OF WASTEWATERS, HELD AT VODGEO HEADQUARTERS, MOSCOW, USSR ON 23-24 AUG 1976.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 703, Price codes: A05 in paper copy, A01 in microfiche. Proceedings 1976. Environmental Protection Agency, Washington, DC., 87 p, 11 fig, 29 tab, 30 ref, 1 append.

Descriptors: *Municipal wastes, *Industrial wastes, *Waste water treatment, Oil industry, Mineral industry, Pulp and paper industry, Activated sludge, Nitrogen, Oxygen, Aeration.

The third cooperative USA/USSR symposium on the intensification of bio-chemical treatment of wastewaters was held in Moscow, USSR, at the Vodgeo Headquarters on August 24 through 25, 1976. Fifteen papers were presented dealing with municipal and industrial wastes. Topics include: biochemical oxidation kinetics, biological treatment of petroleum industrial wastes, treatment of steel industry wastes, nitrogen control in municipal waste water, oxytanks, treatment of kraft pulp wastes, effects of steroids on biological treatment, activated sludge processing with pure oxygen, treatment of organic chemicals industry wastes, treatment of waste water from wool scouring, improvements in municipal sewage treatment. (See W79-08782 thru W79-08796) (Small-FRC)
W79-08781

KINETICS OF BIOCHEMICAL OXIDATION,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
S. V. Yakovlev, I. V. Skirdov, C. I. Rogovskaya, and V. N. Shvetsov.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976. p 4-15, 1976. 15 fig.

Descriptors. *Kinetics, *Biological treatment, *Equations, *Laboratory tests, Carbon, Biochemical oxygen demand, Chemical properties, Chemical reactions, Oxidation.

Biological treatment kinetics were investigated under laboratory conditions. The effect of substrate concentration on the biological treatment rate may be described by the Michaelis-Menton Equation. The Ierusalimsky Equation describes the effect of MLVSS upon the rate of biological treatment. The equation of a bisubstrate reaction with two-stage enzyme substitution describes the joint effect of substrate and D.O. concentrations. A generalized kinetic equation was obtained taking into account the effects of the main components of biological oxidation. An increase in the number of carbon atoms in the substance causes a decrease in the biochemical oxidation rate and an intensification of biological systhesis processes. Process kinetics are affected by the various functional groups available and their position in the molecule. The highest destruction rate is observed when the number of carbon atoms in the molecule is the same and the various functional groups determining chemical properties are available. Experimental data analysis demonstrated the correlation between V max and BOD/COD. (See also W79-08781) (Small-FRC)

W79-08782

CHEMICAL ADDITIONS TO BIOLOGICAL TREATMENT OF PETROLEUM REFINERY WASTEWATER,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
A. Cywin.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976, p 16-21. 1976, 5 fig, 7 ref.

Descriptors: *Oil industry, *Biological treatment, *Chemical reactions, Colloids, Suspended solids, Neutralization, Oxidation, Coagulation, Filtration, Nutrients.

Chemical additions for the treatment of specific petrochemical wastes during biological treatment are described. The most common methods include neutralization and pH adjustment, coagulation-precipitation, oxidation processes, coagulation/mixed media filtration, colloidal destabilization, and nutrients. The unit process within a treatment system should be optimized to remove soluble contaminants by biological processes. Pretreatment will enhance the efficiency of the biological treatment by removing colloidal and suspended matter. Operating and equipment costs are reduced using chemical pretreatment. In the raw waste loads, most of the BOD and COD occurs as colloidal or suspended matter; thus, using chemical pretreatment, an effluent can be produced of drinking water quality. (See also W79-08781) (Small-FRC)
W79-08783

THE TRENDS IN INTENSIFICATION IN BIO-CHEMICAL TREATMENT OF HIGH DENSITY WASTEWATER,
Leningrad Civil Engineering Inst. (USSR).
S. M. Shifrin, B. G. Mishookov, G. V. Ivanov, and E. K. Goloobovskaya.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976. p 22-24, 1976, 2 fig.

Descriptors: *Biological treatment, *Aeration, *Coagulation, *Flotation, *Optimization, Suspended solids, Sludge treatment.

Positive results in the field of biological water treatment intensification were obtained by special preparation of waste water before aeration. Electric flotation coagulation reduced contaminant concentration by reducing suspended solids. Suspended solids were decreased by 95-98%, COD was reduced by 60-70%, and BOD was also reduced. The optimum aeration time was found to be the reverse ratio of sludge concentration. The limits of the sludge dose are determined by feeding or the contamination concentration in the water treated. Thus, the waste water treatment process is determined not only by the sludge loading but by impurities density in the aeration tank. Usually it is most advantageous to carry out the process at minimum sludge dose. (See also W79-08781) (Small-FRC)
W79-08784

STEEL INDUSTRY WASTEWATER TREATMENT USING BIOLOGICAL-CHEMICAL TECHNOLOGY,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
W. J. Lacy.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976. p 25-29, 1976. 7 fig, 5 ref.

Descriptors: *Mineral industry, *Industrial wastes, *Ammonia, *Nitrification, *Denitrification, Waste water treatment, Activated sludge, Anaerobic treatment, Dewatering.

Treatment of steel industry waste water is described. Basic processing operations result in suspended solids, oils, waste acids, ammonia, cyanides, phenols, chlorides, fluorides, sulfides, heavy metals, and heated discharges. Two biological-chemical treatments that can be applied to steel manufacturing waste waters are described in detail: ammonia stripping, and denitrification. Ammonia stripping depends upon four factors: the pH of the wastewater, rate of gas transfer, air-to-liquid requirements, and the hydraulic loading. Crosscurrent ammonia stripping towers are described. The minimum air/liquid loading required to obtain 90% removal is approximately 2000 liters of air/liter of waste water. Biological nitrification of ammonia concentrations as high as 500 mg/liter with greater than 90% removal can be obtained with the single-stage activated sludge process. Two-stage systems can achieve greater than 97% removal. Denitrification systems include anaerobic activated sludge, anaerobic ponds, and upflow anaerobic filters. Technologies to be implemented in the future include: slag and sludge dewatering and disposal, a closed-loop system, electro-membranes during the H2SO4 pickling operation, and a new technology which uses the direct reduction of low grade taconite ore. (See also W79-08781) (Small-FRC)
W79-08785

FACILITIES IMPROVEMENT FOR BIO-CHEMICAL TREATMENT OF PETROLEUM REFINERY WASTEWATER,
Bashkirian Scientific Research Inst. of Petroleum Refining (USSR).
V. Ya. Gerber.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR on August 23-24, 1976. p 30-31, 1976.

Descriptors: *Oil industry, *Oily water, *Tertiary treatment, *Activated sludge, *Oxidation, Performance, Biological treatment, Oil, Biochemical oxygen demand, Phenols.

Performance specifications are presented for designing biochemical treatment facilities at refineries and petrochemical plants. Single or two stage treatment systems are recommended depending upon the quality of the waste. The activated sludge units in use are described, and operating data is presented for secondary treatment and advanced treatment. All refineries and petrochemical plants located within the Volga and Urals basins utilize biochemical treatment. The most widely used equipment is activated sludge systems with many feeds and complete mixing. Treatment efficiency of two-step facilities is 10 to 15% better than one-step facilities. For oily water, two-step facilities have a BOD removal of 93-98%, oil removal of 77-86%, and phenol removal of 99-100%. When advanced treatment in oxidation ponds is added, the final effluent has the following composition: COD (mg O2/liter) 60 to 80, BOD (mg O2/liter) 2 to 8, ether-solubles 4 to 8, oil 1 to 2, and phenols 0.0 to 0.002. (See also W79-08781) (Small-FRC)
W79-08786

BIOLOGICAL METHODS FOR CONTROL OF NITROGEN IN MUNICIPAL WASTEWATERS,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
W. A. Rosenkranz.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR on August 23-24, 1976. p 32-35, 1976. 4 fig, 2 tab, 5 ref.

Descriptors: *Activated sludge, *Nitrification, *Denitrification, *Municipal wastes, Sludge treatment, Biochemical oxygen demand, Nitrogen, Suspended solids, Aerobic treatment, Anaerobic treatment, Pilot plants.

The operating conditions for the activated sludge process were investigated to select conditions which will produce efficient nitrification and denitrification with the indigenous carbonaceous material in the waste water as the electron donor. At a pilot plant in Washington, D. C., alternate periods of aerobic and anaerobic conditions were provided within the reactor and the reactor was operated at sufficiently low food-to-microorganisms ratios to ensure a nitrifying population. During nine months of operation the plant operated at a food-to-mass ratio of about 0.1 lb BOD/lb MLVSS/day (0.1 g/g/day). Nitrogen removals varied from 54 to 84%. A full-scale plant evaluation project is also described. BOD and suspended solids removal have been better than 90%, nitrification has been complete, and total nitrogen removal has been in excess of 80% without the addition of organic supplement. (See also W79-08781) (Small-FRC)
W79-08787

OPERATION EXPERIENCE OF OXYTANKS,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
I. V. Skirdov, V. N. Shvetzov, A. A. Bondarev, B. J. Lurje, and N. G. Bereykina.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR on August 23-24, 1976, p 36-40. 1976, 5 fig, 3 tab.

Descriptors: *Oxygenation, *Oxygen, *Activated sludge, *Treatment facilities, Biological treatment, Performance, On-site tests, Ammonia, Costs, Air pollution.

The oxytank system, which utilizes pure oxygen and high concentrations of activated sludge, for biological waste water treatment is described. The system is characterized by highly efficient oxygen utilization, reduced construction size due to the fact that three processes are combined in a single sludge separation tank, and an automatic oxygen supply regulated by organic impurities concentration. Full-scale demonstration plants confirmed experimental data on plant performance. The oxytank had an oxygenation capacity 3.5 times greater than that for aeration tanks. Because of the use of pure oxygen, the activated sludge concentration can be maintained at 6-10 g/liter at a high dissolved oxygen concentration of 10-12 mg/liter. The settling properties of activated sludge are improved. The oxytank system eliminates the discharge of volatile components into the atmosphere. However, when ammonia stripping is not performed, the ammonium nitrogen content in the oxytank was higher than in aeration tanks. With oxytanks, capital expenditures were reduced by 1.5 to 2 times, and operating expenditures were decreased by 1.4 to 1.6 times. (See also W79-08781) (Small-FRC)
W79-08788

IMPROVEMENTS FOR KRAFT PULP AND MUNICIPAL TREATMENT PROCESSES,
Envirotech Corp., Menlo Park, CA.
F. P. Sebastian, and D. S. Lachtman.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976. p 41-50, 1976. 14 fig, 13 ref, 1 append.

Descriptors: *Pulp and paper industry, *Filtration, *Analytical methods, *Recycling, *Energy budget, Municipal wastes, Industrial wastes, Waste water treatment, Carbon, Economics, Monitoring.

Three treatment modifications are discussed for kraft pulp plants and municipal treatment processes. The closed-cycle mill is described which can be a modification of existing kraft mills and totally eliminates contaminated effluents while saving enough through operating expenses to recover its capital expenditures within two years. A high solids filter is described which has application for both municipal and industrial sludge processing. This development can reduce energy consumption and increase energy recovery in sludge thermal systems. The TOC analyzer is described which has applications for industrial and municipal treatment processes. It is a reliable and quick measurement tool that improves waste treatment efficiency through a network of feedforward and feedback control strategies in addition to it application as a monitoring device. (See also W79-08781) (Small-FRC)
W79-08789

BIOLOGICAL WASTE WATER TREATMENT IN THE PRESENCE OF STEROID COMPOUNDS,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
S. V. Yakolev, and T. A. Karjukhina.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR on August 23-24, 1976, p 50-53, 1976. 7 tab.

Descriptors: *Oxidation, *Lipids, *Aeration, *Performance, Biological treatment, Activated sludge, Toxicity.

The possibility was investigated of stimulating biological oxidation in aerobic conditions by the addition of steroid compounds to the water being treated. The steroids methyltestosterone, testosteronepropionate, progesterone, and pregnine were studied using synthetic waste water containing peptone, buffer ammonium salt, and dipotassium hydrogen phosphate. Three sets of experiments were carried out: oxidation in Warburg apparatus, synthetic waste water treatment in mixing aeration tank models, and aerobic mineralization of activated sludge. The addition of steroids had a marked effect on the BOD value of the waste water measured by the dilution method. The direct addition of the steroids in dry powder form sharply stimulated biological oxidation. Steroids added in alcohol solutions had less effect. Steroids can be used as a measure for the protection of activated sludge bacteria against the action of toxic substances. (See also W79-08781) (Small-FRC)
W79-08790

A COMPARISON OF CONVENTIONAL ACTIVATED SLUDGE PROCESS AND PURE OXYGEN ACTIVATED SLUDGE PROCESS FOR A 75-MGD SECONDARY TREATMENT FACILITY,
Orange County Sanitation Districts, Fountain Valley, CA.
F. A. Harper.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976, p 54-59, 1976. 2 fig, 6 tab.

Descriptors: *Activated sludge, *Oxygen, *Sewage treatment, *Costs, *Performance, Municipal wastes, Filtration, Land use, Maintenance.

A pure oxygen system was selected over a conventional air system for a 75 mgd facility because it adequately and economically produced effluent which met state and Federal requirements. The four alternative systems which were considered are described and discussed. These include: air activated sludge, pure oxygen activated sludge, roughing filter and activated sludge, and roughing filter and pure oxygen activated sludge. The pure oxygen activated sludge offered an 18% savings in project cost over the next cost-effective alternative. This system provides a degree of treatment which will meet effluent standards and will provide cost savings in maintenance, operation, and power requirements. Digester gas generated by the facility will provide 5830 horsepower. Also, with this alternative there are savings in land utilization. (See also W79-08781) (Small-FRC)
W79-08791

STUDIES OF ARTIFICIAL AERATION ON THE LITHUANIAN SSR,
Kaunasskii Politekhnicheskii Inst. (USSR).
A. L. Skirckiavichus.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976, p 60-61, 1976.

Descriptors: *Aeration, *Aerobic treatment, *Rivers, *Performance, Waste water treatment, Water pollution sources, Municipal wastes.

Artificial aeration of the Nevejis River with mechanical C-16 aerators was investigated. The river was polluted with insufficiently treated waste waters of Panevejis. The aerators which have a capacity of 2.2 kw were mounted from 4 to 9 inches on a metal frame with pontoons. Detailed DO measurements were made at 5 and 10 m distances both upstream and downstream of the aerators. Studies of barbotage aeration were also conducted, and artificial aeration was investigated in tanks. Lower efficiencies were obtained than expected for river aeration. Waste water treatment plants cannot be replaced by artificial aeration, but artificial aeration could be an economical and effective method of partially controlling river DO problems. A larger unit is being tried in the river to eliminate anaerobic areas. (See also W79-08781) (Small-FRC)
W79-08792

WASTEWATER TREATMENT CONCERNS OF THE ORGANIC CHEMICALS INDUSTRY IN THE UNITED STATES,
Associated Water and Air Resources Engineers, Inc., Nashville, TN.
C. E. Adams, Jr., and B. T. Sumner.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976. p 62-70, 1976. 10 tab.

Descriptors: *Chemical industry, *Industrial wastes, *Regulation, Filtration, Biological treatment, Activated carbon, Performance, Permits.

A review is presented of the organic chemicals industry, its waste water characteristics, and waste water treatment methods commonly employed. The treatment techniques utilized in the United States and the achievable treatment level proposed by the government are discussed. Biological treatment, granular media filtration, and activated carbon adsorption are considered. The problem of issuing permits when there is effluent variability is discussed. (See also W79-08781) (Small-FRC)
W79-08793

BIOLOGICAL TREATMENT OF HIGHLY CONCENTRATED WASTEWATERS FROM WOOL-SCOURING OPERATIONS,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodoznabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
I. V. Skirdov, V. N. Shvetzov, K. M. Morosova, and L. A. Gubina.
In: USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976, p 70-74, 1976. 7 fig, 1 tab.

Descriptors: *Industrial wastes, *Aerobic treatment, *Performance, Anaerobic treatment, Waste dilution, Activated sludge, Aeration.

The feasibility of wool-scouring waste water treatment in digesters followed by final treatment in aeration tanks and complete biological treatment under aerobic conditions was investigated. The studies were conducted on natural waste water generated by a worsted factory where wastes were treated using soap and soda. Laboratory studies demonstrated that treated effluent from digesters with unoxidized organic material content of 3000 mg/liter on a total BOD basis can be treated successfully without dilution in complete mixing aeration tanks. Also, waste waters with a total BOD of 8000 to 9000 mg/liter can be treated in two-stage completely mixed aeration tanks without preliminary anaerobic digestion and dilution. (See also W79-08781) (Small-FRC)
W79-08794

ANALYTICAL AND PROCESS IMPROVEMENTS IN BIOLOGICAL TREATMENT OF MUNICIPAL WASTE WATERS,
W. J. Love.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976. p 74-78, 1976.

Descriptors: *Monitoring, *Control, *Operations, *Treatment facilities, *Biological treatment, Activated sludge, Industrial wastes, Biochemical oxygen demand.

Analytical and process control programs for biological treatment plants are outlined, and some problems which have occurred in plant operation are discussed. Process control for a 10 mgd activated sludge plant which treats a brewery waste having 1000 mg/liter BOD is described. Daily, samples are analyzed for TSS, SS, VSS, BOD, COD, TOC, TKN, NH3-N, ortho PO4, DO, pH, temperature, and turbidity. All effluent and process flows are metered and recorded. The data is used to adjust the biological process so that effluent standards can be met. Alterations to process control systems because of foaming, capacity upgrading, diurnal variation, septic sewage treatment, and other process modifications are discussed. A pilot study of a proposed lime clarification-biological nitrification advanced waste water treatment process is reviewed. (See also W79-08781) (Small-FRC)
W79-08795

DEVELOPMENT AND IMPROVEMENT OF THE MUNICIPAL SEWAGE BIOLOGICAL TREATMENT FACILITIES,
A. Yershov, M. Kyghel, and M. Zemlyak.
In: 3rd USA/USSR Symposium on Intensification of Bio-Chemical Treatment of Wastewaters, held at Vodgeo Headquarters, Moscow, USSR, on August 23-24, 1976, p 78-80, 1976.

Descriptors: *Aeration, *Activated sludge, *Municipal wastes, *Sewage treatment, Flow rate, Performance, Sedimentation, Biochemical oxygen demand.

A new design aeration tank is described which was developed by the Scientific Research Institute for Municipal Economy. Aeration tank-clarifiers were developed which include a system of baffles which provide direct circulation of mixed liquid. The downtake flow rate increases, and an activated sludge, fluidized-bed is formed. The stabilized fluidized bed exists because of the increased recirculation of mixed liquid and the intensification of mass exchange between aeration and clarification zones. Two sizes of the tanks have been developed: for municipal treatment stations with a capacity of either 1700 cu m/day or 160,000 cu m/day. Total sewage retention time in the tanks was 13 hr at the oxidation rate of 22.6 mg/BOD/g of sludge, and after reconstruction, was 7.73 hr at an oxidation rate of 25.2 mg/BOD/g of sludge. Further modifications of the tanks are planned including increasing the surface of the fluidized bed without increasing the volume. (See also W79-08781) (Small-FRC)
W79-08796

5E. Ultimate Disposal Of Wastes

LEACHING ASPECTS OF OIL SLUDGE BIODEGRADATION IN SOIL,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Biochemistry and Microbiology.
J. T. Dibble, and R. Bartha.
Soil Science, Vol. 127, No. 6, p 365-370, June 1979. 4 fig, 2 tab, 23 ref.

Descriptors: *Oil wastes, *Sludge, *Biodegradation, Laboratory tests, Lysimeters, Nutrients, Fertilizers, Nitrogen, Phosphate, Carbon, Organic compounds, Leachate, Chemical analysis, Waste disposal, Degradation(Decomposition), Soils, Soil science, Oil sludge.

Efficient disposal of waste oil sludges by biodegradation in soil ('land farming') requires management practices that include fertilizer addition. The effect of such practices on soil leachate quality was studied in lysimeter columns containing 5% (wt/wt) hydrocarbon in a soil-sand mixture. Fertilizer was added in various formulations at a carbon:nitrogen and carbon:phosphorus ratio of 200:1 and 2640:1, respectively. As expected, undegraded hydrocarbons did not appear in the leachate, nor was phosphate eluted from the limed soil-sand mixture. A

very moderate increase in total organic carbon of the leachate occurred due to hydrocarbon biodegradation. When nitrogen was applied as urea or as a urea-paraffin adduct, 23 and 19% of the added nitrogen were eluted in the leachate, respectively. No nitrogen appeared in the leachate when nitrogen was applied as urea formaldehyde. The above results and additional cited reports indicated that judiciously located and operated land-farming sites are not likely to endanger underground aquifers. (Sims-ISWS)
W79-08629

A MANAGEMENT MODEL FOR DETERMINING EFFLUENT STANDARDS FOR THE ARTIFICIAL RECHARGE OF MUNICIPAL AND INDUSTRIAL WASTEWATERS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
R. Willis.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 287-308, September 1976. 4 fig, 2 tab, 19 ref, 1 append.

Descriptors: *Waste water disposal, *Artificial recharge, *New York, *Model studies, *Water management(Applied), Mathematical models, Analytical techniques, Industrial wastes, Municipal wastes, Water quality, Water quality standards, Groundwater, Effluents, Sprinkler irrigation, Land use, Planning, Optimization, Water spreading, Land disposal systems, Basin spreading.

Two planning models were developed for the optimal land disposal of wastewater effluents in spray irrigation or basin spreading land disposal systems. The models consider the operation of the disposal systems over an individual (a static model) or a sequence of interdependent disposal cycles (a dynamic model). The objectives of the models were to estimate the required treatment of a given waste load to prevent the possible degradation of the soil or groundwater system. The management models are predicated upon the partial differential equations characterizing mass transport in soils. The models incorporate time-dependent non-equilibrium adsorption and first-order chemical or biochemical reactions. The Galerkin finite-element method transforms the system's transport and adsorption equations into systems of ordinary differential equations. The transformed equations, which are the response equations of the system, are imbedded within the constraint sets of the planning models. The planning models, structured as linear programming problems, determine the optimal effluent standards and the time and spatial variation of constituent concentrations within the soil system. The planning models were applied to a spray irrigation site disposing of food processing waste in western New York. Effluent standards, expressed as the maximum concentration of dissolved organics in the disposal system, were estimated for a range of groundwater quality standards. The effluent standards may be used in the preliminary design and operation of conjunctive ground and surface wastewater treatment systems. (See also W79-08631) (Humphreys-ISWS)
W79-08654

5F. Water Treatment and Quality Alteration

AN ASSESSMENT OF OZONE AND CHLORINE DIOXIDE TECHNOLOGIES FOR TREATMENT OF MUNICIPAL WATER SUPPLIES: EXECUTIVE SUMMARY,
Public Technology, Inc., Washington, DC.
G. W. Miller, R. G. Rice, C. M. Robson, R. L. Scullin, and W. Kuhn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 196, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/8-78-018, 1978. 78 p, 19 fig, 6 tab, 38 ref, 2 append.

Descriptors: *Chlorination, *Ozone, *Water treatment, *Potable water, *Europe, Surveys, Treatment facilities, Operation and maintenance, Odor, Taste, Disinfection, Control systems.

The US EPA's Municipal Environmental Research Laboratory, Drinking Water Research Division, sponsored a study of ozone and chlorine dioxide drinking water treatment technologies currently practiced in Europe and Canada. In addition to 1192 questionnaires sent to European water treatment plants, 20 ozone plants located in Europe were visited by the study team; six Canadian plants were also visited. Most of the plants visited utilized tubular ozonators, primarily the water cooled, horizontal tube type. Contacting systems, control systems, and operation and maintenance requirements are also reviewed. Ozone is currently utilized in more than 1000 water treatment plants worldwide to remove colors, tastes, odors, algae, organics, metal contaminants, turbidity, and to flocculate soluble organics and to inactivate viruses. Chlorination of the water often follows ozone treatment to maintain a chlorine residual. In the treatment of water with chlorine dioxide, the oxidant is usually produced from sodium chlorite or sodium chlorate. Thirteen water treatment plants in the U. S. utilizing chlorine dioxide were visited. Most of these plants utilize chlorine dioxide to control taste and odor problems or to reduce manganese, and 12 of the plants generate the oxidant from gaseous chlorine and sodium chlorite. A visit was also made to 15 European water treatment plants utilizing chlorine dioxide. The design and costs of some of these chlorination systems are described. (Lisk-FRC)
W79-08729

COMPUTER COST MODELS FOR POTABLE WATER TREATMENT PLANTS,
Municipal Environmental Research Lab., Cincinnati, OH. Water Supply Research Div.
For primary bibliographic entry see Field 6B.
W79-08807

MARKETABLE EFFLUENT PERMITS FOR THE CONTROL OF PHOSPHORUS INFLUENT INTO LAKE MICHIGAN,
Wisconsin Univ.-Madison. Social Systems Research Inst.
For primary bibliographic entry see Field 6C.
W79-08809

5G. Water Quality Control

NONPOINT SOURCE CONTROL GUIDANCE, HYDROLOGIC MODIFICATIONS.
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 4D.
W79-08609

WATER QUALITY GUIDELINES FOR ACID MINE DRAINAGE AND STRIP MINE AREAS IN IOWA,
Energy and Mineral Resources Research Inst., Ames, IA. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5B.
W79-08611

LEACHING ASPECTS OF OIL SLUDGE BIODEGRADATION IN SOIL,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Biochemistry and Microbiology.
For primary bibliographic entry see Field 5E.
W79-08629

ENVIRONMENTAL EFFECTS OF WESTERN COAL COMBUSTION PART I - THE FISHES OF ROSEBUD CREEK, MONTANA,
Montana Fish and Game Dept., Miles City.
For primary bibliographic entry see Field 5A.
W79-08657

A NEW UNITED STATES BIOMONITORING SYSTEM FOR THE AQUATIC ENVIRONMENT,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W79-08661

SILVICULTURAL CHEMICALS AND PROTECTION OF WATER QUALITY.
Oregon State Univ., Corvallis. School of Forestry.
For primary bibliographic entry see Field 5C.
W79-08769

URBAN RUNOFF TREATMENT METHODS. VOLUME I - NON-STRUCTURAL WETLAND TREATMENT,
Hickok (Eugene A.) and Associates, Wayzata, MN.
For primary bibliographic entry see Field 6F.
W79-08773

AREAWIDE ASSESSMENT PROCEDURES MANUAL. VOLUME I,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W79-08797

AREAWIDE ASSESSMENT PROCEDURES MANUAL. VOLUME II,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W79-08798

AREAWIDE ASSESSMENT PROCEDURES MANUAL, VOLUME III,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W79-08799

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE ROLE OF CONSERVATION IN WATER SUPPLY PLANNING,
Southern Illinois Univ. at Carbondale. Dept. of Geography.
D. D. Baumann, J. J. Boland, J. H. Sims, B. Kranzer, and P. H. Carver.
Prepared for U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia, April 1979. IWR Contract Report 79-2. 123 p, 16 tab, 87 ref. DACW72-78-C-D022.

Descriptors: *Water conservation, *Water management(Applied), Water policy, Water supply, Project planning, Conservation, Evaluation, Analytical techniques, Environmental effects, Methodology, Water utilization, Water resources development.

A definition of water conservation is formulated, the adequacy of knowledge on the available conservation measures is assessed, and the requirements and needs for implementation are identified. Conservation is attained when a measure results in a reduction in use and the overall benefits exceed the costs. There are several major weaknesses inherent in the evaluations of conservation measures because most did not rely on analyses of carefully designed empirical studies. Cost estimates and information necessary for implementation of management and planning measures are poorly understood and are a priori at best. Little is known about the range of possible environmental effects of water conservation. Analysis of conservation measures must focus not only upon specific measures, but also upon the effects of combinations of measures. Information requirements, method of analysis, and salient problems are identified; the analytical approach described does not follow the process of traditional water planning procedures. The report provides the conceptual basis of water

conservation planning and purposes a methodology. The theoretical approach is presented not with the expectation that it will be implemented, but with the recommendation that model plans be prepared and made available to those in the field. (Schaefer-IPA)
W79-08595

A NATIONAL APPROACH TO WATER RESOURCES MANAGEMENT,
Australian Water Resources Council, Canberra.
1978. 7 p. Australian Government Publishing Service, Canberra.

Descriptors: *Water management(Applied), *Water resources development, Water resources, Water conservation, Water policy, Australia, Natural resources, Planning, Water supply development, Programs.

Important basic principles and goals underlying the approach to the development and management of water resources in Australia are identified. A broad framework is provided for the general development of programs as well as an outline of the main activities likely to be involved. It is recognized that in the management of water there is abundant evidence of the interdependence of the elements of the whole environment. Full consideration must be given to the effects on estuarine and marine environments in the management strategies adopted for Australia's inland waters. Social objectives and economic efficiency must also be given proper weight. Responsibility for development and management of water resources in the States and Territories rests primarily with the respective governments. Each government also retains the right to determine the basis for implementing particular proposals. (Schaefer-IPA)
W79-08601

ION EXCHANGE REACTIONS IMPORTANT IN GROUNDWATER QUALITY MODELS,
Geological Survey, Denver, CO. Water Resources Div.
D. B. Grove.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 144-152, September 1976. 22 ref.

Descriptors: *Ion exchange, *Groundwater, *Model studies, *Ion transport, *Chemical reactions, Groundwater movement, Geochemistry, Water quality, Path of pollutants, Analytical techniques, Computer models, Laboratory tests, On-site investigations, Equations.

Ion exchange is an important chemical reaction occurring during movement of solutes through the ground-water system. Equilibrium-controlled ion-exchange reactions, including the evaluation of selectivity coefficients, distribution coefficients, and exchange isotherms, are reviewed. When the exchange process is rate controlled, investigators have shown that ion transfer between the fluid and the reaction surface is determined by either film or particle diffusion. Models assuming equilibrium-controlled exchange are simpler than those for the rate-controlled exchange and sometimes sufficient to describe the exchange process. The effect of radioactive decay is illustrated in the general transport equation. Several laboratory and field studies are discussed. (See also W79-08631) (Woodard-USGS)
W79-08643

INTERTEMPORAL CONTROL OF GROUNDWATER IN MULTIAQUIFER MODELS,
Montana State Univ., Bozeman. Dept. of Agricultural Economics and Economics.
O. R. Burt.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 279-286, September 1976. 10 ref.

Descriptors: *Aquifer systems, *Model studies, *Groundwater, *Aquifer management, Theoretical analysis, Optimization, Analytical techniques, Mathematical models, Systems analysis, Water management(Applied), Water storage, Stochastic processes, Dynamic programming, Water control, Economics, Decision making, Water policy.

The multiaquifer storage problem was formulated as a dynamic programming problem from which an approximately optimal decision rule was derived analytically. The method of approximation focuses on the unknown function of the functional equation of dynamic programming. The decision rule for a given set of storage levels in the aquifers at a point in time is obtained as the solution of a system of equations equal in number to the number of interrelated aquifers in the model. This approach to multiaquifer management would permit division of a basin into an arbitrary number of interrelated aquifers for modeling purposes, and thus permit relatively precise control of groundwater storage throughout the basin. Importance of the equilibrium state of storage under an optimal decision rule was discussed, particularly as it relates to fixed pumping capacity under stochastic recharge. (See also W79-08631) (Humphreys-ISWS)
W79-08653

STOCHASTIC MANAGEMENT OF A STREAM-AQUIFER SYSTEM,
Universidad Nacional Automona de Mexico, Mexico City. Inst. de Geofisica.
W. E. Z. Flores.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 309-328, September 1976. 6 fig, 1 tab, 34 ref.

Descriptors: *Aquifer systems, *Aquifer management, *Model studies, *Conjunctive use, *Mexico, Mathematical models, Surface waters, Analytical techniques, Groundwater resources, Surface-groundwater relationships, Management, Stochastic processes, Decision making, Optimization, Costs, Economics, Risks, Water management(Applied).

The objective of this study was to develop and evaluate a simple management technique through which the cost of conjunctive operation of surface water and groundwater resources can be minimized under the effect of uncertainty. A lumped parameter model represented the physics of the system, and a linear outflow equation simulated the stream-aquifer flow. A subsurface outflow constant related to the response time of the aquifer proved to be an important concept in the simulation process. Furthermore, a drawdown correction was developed to compute the drawdown at wells. In the developing of the management model, dynamics in the operation of the system were obtained by using linear decision rules. The nonlinear optimization problem (pumping cost dependent on the drawdown and the pumping volume) was solved by an iterative procedure which uses a standard linear programming package. To study the effect of randomness in the system, uncertainties in the water demand, natural inputs and the physical properties of the system were considered. A stochastic differential equation governed the system, and some of the statistics were obtained via spectral analysis. In addition, a conditional probability approach was followed to account for a random subsurface outflow constant. Chance constraints were introduced to include probabilities of satisfaction of constraints. An application to a basin in northwestern Mexico showed the capability of the proposed model in regional management problems involving hundreds of wells and large surface water facilities. A sensitivity analysis showed a larger increase in the operational cost due to uncertainty in the water demand than to uncertainty in the aquifer parameters. (See also W79-08631) (Humphreys-ISWS)
W79-08655

FLOW TO WATER-TABLE WELLS DERIVING THEIR DISCHARGE FROM CAPTURE,
Geological Survey, Reston, VA. Water Resources Div.
S. S. Papadopulos.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 329, September 1976.

Descriptors: *Water table aquifers, *Zone of saturation, *Water loss, *Evapotranspiration, *Aquifer management, Discharge(Water), Drawdown, Groundwater recharge, Water wells, Water level fluctuations, *Water capture.

Unconfined aquifers having a high water table commonly lose a considerable amount of water through evapotranspiration and (or) they cannot accept all the water available for discharge. The rate of this loss depends on the depth of the water table. As the depth to the water table increases, the rate of loss decreases until a depth is reached at which the loss is eliminated. Wells pumping from aquifers initially having a high water table and, consequently, a high evapotranspiration loss can capture part or all of this loss by lowering the water table. Infiltration may also increase, thereby providing additional recharge. The relation between rate of capture and depth to water table can be closely approximated by assuming that capture increases linearly with depth to water table until a maximum rate is reached at a certain critical depth, and that it remains constant, at this maximum rate, for depths greater than the critical depth. On the basis of this assumption, equations can be derived to describe the flow to wells that obtain their yields from capture. These equations can be used to estimate the discharge and the drawdown distribution around such wells. In addition to these single-well equations, equations can be used for designing well networks spaced to attain maximum capture. (See also W79-08631) (Woodard-USGS)
W79-08656

MATHEMATICAL MODEL FOR SIMULATING DISCHARGES ON THE SABINE RIVER BETWEEN TATUM AND RULIFF, TEXAS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W79-08695

ELEVATIONS AND DISCHARGES PRODUCED BY A SIMULATED FLOOD WAVE ON THE LOWER SABINE RIVER, LOUISIANA AND TEXAS, CAUSED BY A THEORETICAL DAM FAILURE,
Geological Survey, Baton Rouge, LA. Water Resources Div.
B. L. Neely, Jr., and G. J. Stiltner.
Geological Survey open-file report 79-678, April 1979. 15 p, 11 fig, 1 ref.

Descriptors: *Dam failure, *Reservoirs, *Discharge(Water), *Flood flow, *Simulation analysis, Mathematical models, Analytical techniques, Streamflow, Flow rates, Stage-discharge relations, Critical flow, Slopes, Elevation, Louisiana, Texas, *Toledo Bend Reservoir, Sabine River.

The Toledo Bend Reservoir is located on the lower Sabine River between Louisiana and Texas. Two mathematical models were coupled to calculate the flood wave that would result from the theoretical failure of 25 percent of Toledo Bend Dam and route the wave downstream to Orange, Tex. Computations assumed failure (1) at the peak of the 100-year flood when discharge of the Sabine River is 102,000 cubic feet per second and (2) when the average discharge is 10,000 cubic feet per second. Two techniques were used in the dam-break model. The method of characteristics was used to propagate the shock wave following dam failure. The linear implicit finite-difference solution was used to route the flood wave following shock wave dissipation. The magnitude of the flow was determined for Burkeville, Bon Wier, Ruliff, and Orange, Tex., along the lower Sabine River. For these sites, respectively, the following peak elevations were calculated: 119, 82, 31, and 13 feet for the 100-year flood and 110, 75, 27, and 9 feet for the average discharge (Woodard-USGS)
W79-08697

WATER-LEVEL PREDICTIONS FOR INDIAN WELLS VALLEY GROUND-WATER BASIN, CALIFORNIA, 1978,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Mallory.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225 printed copy $4.00, microfiche $3.50. Geological Survey open-file report 79-254, February 1979. 28 p, 11 fig, 2 tab, 14 ref.

Descriptors: *Water wells, *Water levels, *Forecasting, *Model studies, *Aquifer characteristics, Pumping, Drawdown, Water levels, Groundwater barriers, Groundwater basins, California, *Indian Wells Valley(Calif), Nodal network, China Lake.

Ground-water pumpage in Indian Wells Valley, virtually a closed basin in the Mojave Desert of southern California, has increased gradually since 1945 and presently exceeds the long-term mean annual recharge (perennial supply). In order to aid in the understanding and management of the ground-water basin, a digital ground-water model was constructed by the U.S. Geological Survey. Since the original development of this model, conditions in the basin, including areal distribution and rates of ground-water pumpage, have changed. The results of simulation for the period 1969-76 constitute a second verification of the original model. Calculated heads for 1976 agree with the observed heads, indicating a good calibration of the original model. A predictive simulation for the period 1977-2020 used pumpage values increasing from about 15,500 acre-feet per year to about 26,000 acre-feet per year. The pumpage used in this report reflects a slightly slower growth rate and a more concentrated pattern of development than that investigated when the model was originally developed. The effects of this pattern of pumpage are reflected in the water levels simulated by the model. Predicted drawdowns for 1983 are less extensive but locally more severe than those predicted earlier. The reversal of the hydraulic gradient between China Lake playa and the city of Ridgecrest, as produced by these drawdowns by the year 2020, suggests that the water-quality effects of such drawdowns should be investigated, as this could result in inferior water from the China Lake playa area flowing southward into areas of withdrawal. (Woodard-USGS)
W79-08699

OPTIMIZATION OF ENERGY ALLOCATION IN WATER AND WASTEWATER TREATMENT SYSTEMS,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
G. D. Zarnett.
Publication No. W65, 1977. 24 p, 9 fig, 7 ref, 3 append.

Descriptors: *Energy budget, *Systems analysis, *Optimization, *Treatment facilities, Planning, Decision making, Waste water treatment.

A technique called dynamic programming is presented which can be applied to water and waste water treatment systems for system optimization. It can be used to evaluate plant performance with respect to effluent quality, operating cost, and energy utilization. Multi-stage decision processes are explained, and a multistage optimization system is described. Examples of applications of dynamic programming are presented. One application is the minimization of pipeline pumping energy for water transmission systems. An example of a multi-unit water treatment plant is detailed. The main advantage of dynamic programming is in its sequential stage-by-stage character of computation. Constraints on either the control or state variables actually simplify the computation rather than make it more difficult because the discretized range on the variables is reduced. Disadvantages include the menace of the expanding grid; inadmissible values may result as the calculation propogates. (Small-FRC)
W79-08720

THE PRINCIPLE OF RATIONAL USE OF NATURAL RESOURCES IN THE THEORY OF OPTIMAL PLANNING,
J. Klackova.
Eastern European Economics, Vol. 16, No. 4, p 3-23, 1978. 1 tab, 19 ref.

Descriptors: *Planning, *Socialism, *Economics, *Natural resources, *Evaluation, *Theoretical analysis, Optimization, Land, Agriculture, Economic efficiency, Prices, Cadastral, Valuation.

Rational use of natural resources has received increasing attention in socialist countries in recent years, closely linked with developing the theory of optimal planning in a socialists economy. A historical survey of resource economics in the U.S.S.R. is followed by sections on: (1) types of natural resources (raw materials and land), (2) evaluation of natural resources, (3) evaluation of planning and project design calculations, and (4) evaluation of agricultural land. Economic evaluation of natural resources in the optimal planning system requires: (1) interchangeability of natural resources, (2) unequal efficiency of interchangeable natural resources, and (3) scarcity of resources compared with needs. Two types of prices are usually recognized in connection with differential evaluation of natural resources in optimal planning theory: (1) cadastral evaluation, relating to all natural resources; and (2) plan or long-range (perspective) evaluation, applied to all insufficiently used and explored resources. In constructing the evaluations two types of natural resources must be distinguished, those whose loss can be compensated for at the present level of scientific and technical knowledge, and those whose loss involves socio-economic damage that cannot be compensated at present knowledge levels. Economic evaluation of losses in the first case is expressed by a finite magnitude, and in the second by an infinite magnitude. (Lynch-Wisconsin)
W79-08800

SOVIET METHODOLOGY FOR THE VALUATION OF NATURAL RESOURCES,
Washington Univ., Seattle. Dept. of Economics.
J. A. Thornton.
Journal of Comparative Economics, Vol. 2, No. 4, p 321-333, December 1978. 20 ref.

Descriptors: *Soviet Union, *Valuation, *Natural resources, *Methodology, *Economics, *Planning, Economic efficiency, Forecasting, Pricing, Evaluation, Resources development, Governments, Decision making, Optimization, Resource extraction, Monitoring.

A draft methodology for the monetary valuation of natural resources in the Soviet national economy was prepared by the Central Economic-Mathematical Institute. Detailed inventories of natural resources are also being produced. The draft methodology is designed for planning and projection. As a planning tool it resolves some methodological difficulties but proposed calculations fall short of dealing with the full problem of dynamic optimization over many sites in an extractive industry. Formulas are calculated on a per-unit basis, and implied cost functions do not allow for substitution between drawdown of resource stocks and quantity of nonresource inputs used in production of a given rate of extractive output. The Soviets also assume away the dependence of the variable cost function on the initial capital investment in the extractive site and the dependence of each year's cost function on earlier extraction decisions. The draft methodology appears more useful for short-run pricing problems than for decentralized plan projection. It is most applicable to relatively fixed factors such as land. It is suggested that improved methods for monitoring and policing stock drawdown and the imposition of efficiency rents would potentially improve use of natural resource stocks. (Lynch-Wisconsin)
W79-08804

DEVELOPMENT OF AN ECONOMICS-BASED METHODOLOGY FOR PROJECTING FUTURE POLLUTION PROBLEMS,
Battle Columbus Lab., Columbus, OH.
G. S. Stacey, and J. E. Flinn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 337. Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600-5-78-011, June, 1978. 85 p, 6 fig, 13 tab, 42 ref, 7 append. 68-01-1837.

Descriptors: *Input-output analysis, *Problem identification and ranking, *Toxins, *Industrial production, *Future planning(Projected), *Forecasting, Pollutants, Economics, Methodology, Planning, Human pathology, Economic prediction, Probability, Systems analysis, Warning systems, Toxicity, Projection.

Economic input-output analysis is the basis for a methodology of identifying and ranking future pollution problems caused by toxic substances. The methodology focuses on the relationship between technical changes in production/products on one hand and generation/dispersion of toxic substances through such products on the other hand, in order to identify potential products of concern. This economic-based methodology is selected in preference over two other techniques: (1) a toxicology-based approach in which an initial screening is based on the potential toxicological properties of the product of concern and subsequent screening uses economic criteria to rank the products according to characteristics of their use in the economy; (2) a scientific opinion-based approach, involving compilation of information from a review of the literature backed up by polling of expert opinion. The economics-based methodology has three main steps: (1) Ranking of products; scores are obtained for growth, dspersion, technical change and value of the various products, and the top-ranked products are noted for further attention. (2) Identification of chemical and toxic substances content in the top-ranked products. (3) Ranking of substances; the frequency, distribution and quality of all toxic substances are summarized and a 'futures' list of toxic substances is drawn up. (Harris-Wisconsin)
W79-08811

6B. Evaluation Process

GLOBAL DESERTIFICATION AND RANGE MANAGEMENT: AN APPRAISAL,
E. G. Van Voorthuizen.
Journal of Range Management, Vol. 31, No. 5, p 378-380, Sept 1978, 5 ref.

Descriptors: *Range management, *Browse utilization, *Evaluation, *Desertification, *Vegetation establishment, Variability, Rainfall, Water conservation, Constraints, Political constraints, Environmental effects, Grazing, Pasture management.

Range management techniques in the water-stressed arid and semiarid regions of the world in general and in the Sahel in particular have in many cases failed, due not to physical hazards but to social and political obstacles. Range management is put on the defense in this analysis in an effort to determine if range management principles are to blame for desertification of once productive areas in the Sahel and other arid zones or if fundamental range management principles have been violated either unknowingly or for the sake of short-term benefits. This evaluation of the Sahelian situation reveals that although conditions are very difficult in this region, managing rangelands for a year-round feed supply for grazing animals is possible by adapting sound range management practices including a greater use of browse species. It is concluded that government and local support is needed for marketing and stock numbers control. (Tickes-Arizona)
W79-08748

NOTES ON THE SYMMETRY OF TAXES AND SUBSIDIES IN POLLUTION CONTROL,
Harvard Univ., Cambridge, MA.
A. M. Polinsky.
The Canadian Journal of Economics, Vol. 12, No. 1, p 75-83, February 1979. 4 fig, 12 ref.

Descriptors: *Economics, *Pollution abatement, *Pollution taxes(Charges), *Subsidies, *Regulation, *Symmetry, Equilibrium, Policy, Equity, Compensation, Economic efficiency, Property rights, Pollution rights.

Certain aspects of a debate among resource economists regarding the symmetry between pollution taxes and subsidies in pollution control are clarified. Conclusions: (1) Criticisms of long-run effects of subsidies do not go far enough, since it is shown that not only does the subsidy induce entrance of an excessive number of firms, but also causes each firm to operate at an inefficient level of production. (2) The subsidy may be assymetric and inefficient even in the short run if policy options are limited politically. The latter would occur if there were a reluctance to subsidize existing firms which shut down as a result of the corrective policy. Related issues of equity and compensations are also discussed; it is argued that a commonly proposed plan to compensate existing firms on a lump-sum basis for the loss of property rights to pollute due to the tax may not be feasible. When firms are thought to have a right to pollute there are no objections to paying firms which left as a result of the corrective policy, but strong objections to paying firms which never produced. It is suggested hypothetically that if firms have a right to pollute, an efficient subsidy could be implemented in the short run, but if firms do not have a right to pollute the tax would be used alone and there would be no need for equity-based compensation. (Lynch-Wisconsin)
W79-08803

SOVIET METHODOLOGY FOR THE VALUATION OF NATURAL RESOURCES,
Washington Univ., Seattle. Dept. of Economics.
For primary bibliographic entry see Field 6A.
W79-08804

THE ECONOMIC VALUE OF RECREATION AND TOURISM, PARK COUNTY, WYOMING, 1976,
Wyoming Univ., Laramie. Agricultural Extension Service.
E. P. Lewis.
Wyoming Agricultural Experiment Station Bulletin, No. 604, March 1978, 36 p. 11 tab, 5 ref, 1 append.

Descriptors: *Park County(NY), *Recreation demand, *Tourism, *Economic impact, *Valuation, *Wyoming, National Parks, Crop production, Mining, Manufacturing, Museums, Rodeos, Recreation, Recreational facilities, Resorts, River float trips, Economics, Baseline studies, Model studies, Employment.

The recreation-tourism industry in Park County, Wyoming, particularly in Cody, is a well-developed and important component of the total economy. Tourist access to Yellowstone and Grand Teton National Parks is directly through the county. Recreation and tourism-related businesses directly provide 948 full-time employment equivalents (FTEs), 15% of total county employment, and indirectly provide 774 FTEs. Such businesses contribute $39.3 million to total Park County output (11% of all direct economic activity). Use of an economic base model shows that changes in the recreation industry would affect a wide cross-section of other local businesses; two illustrations are given. The four primary industries in the county are agriculture, mining (including oil and gas extraction and production), light manufacturing, and recreation-tourism. Five recreation-tourism sectors are identified: (1) trade (gasoline, groceries, liquor, clothing, souvenirs, etc.), 349 FTEs and $30.7 million; (2) eating, dinking, and lodging, 435 FTEs and $5 million; (3) dude ranches and outfitters, 63 FTEs and $1.1 million; (4) resorts and lodges, 60 FTEs and $1.1 million; and (5) other recreational services (museums, river float trips, rodeos), 41 FTEs and $1.4 million. This report represents an update of an input/output economic base study published in 1977. (Lynch-Wisconsin)
W79-08805

COMPUTER COST MODELS FOR POTABLE WATER TREATMENT PLANTS,
Municipal Environmental Research Lab., Cincinnati, OH. Water Supply Research Div.
D. L. Guttman, and R. M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 744, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-181, September 1978. 58 p, 11 fig, 26 tab, 7 ref, 1 append.

Descriptors: *Water treatment, *Potable water, *Water purification, *Computer programs, *Computer models, *Costs, Chlorine dioxide, Chlorination, Chloramination, Ozone, Operating costs, Maintenance costs, Capital costs, Safe Drinking Water Act, Cost analysis, Water quality control, Chloroform, Trihalomethanes, Treatment facilities.

Computer programs were developed to determine costs for five different unit treatment techniques aimed at encouraging public water utilities to meet the legal and aesthetic standards of the Safe Drinking Water Act: (1) chlorination; (2) chlorine dioxide; (3) chloramination; (4) ozone; and (5) granular activated carbon. The five computer programs have been used to calculate costs of removing chloroform and other trihalomethanes from drinking water (described in a companion report). Costs generated by these programs are categorized as capital costs and operation/maintenance costs. Capital costs include: construction for site preparation, plant construction, legal services, fiscal and administrative services, interest during construction, and start-up. Operation/maintenance costs include: chemical and raw material needs, labor, utilities, and annual replacement of expendables. Costs are adjusted to current dollars using U.S. Environmental Protection Agency's Sewer and Sewage Treatment Plant Construction Cost Index and the Wholesale Price Index. Values for certain design variables are given so that a test run can be made on the program and compared to sample printouts shown in an appendix. A final table in each section shows costs for each treatment process at five different flow rates. (Harris-Wisconsin)
W79-08807

EVALUATION OF ECONOMIC BENEFITS OF RESOURCE CONSERVATION,
Environmental Law Inst., Washington, DC.
R. C. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 973, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/5-78-015, September 1978. 42 p, 2 fig, 2 tab, 43 ref. R803880-01-1.

Descriptors: *Natural resources, *Recycling, *Market value, *Economic efficiency, *Prices, Conservation, Hotelling model, Scarcity, Rate of extraction, Optimal pricing, Elasticity of demand, Elasticity of supply, Discount rates, Regulation, Social values, Resource depletion, Withdrawal.

Basic tenets of the conservation movement in general and the currently-popular recycling activity in particular are that most resources (1) are too cheap; (2) are wastefully exploited; and (3) shall soon become exhausted, depriving future generations of their use. Central to these points are the value placed on undeveloped virgin natural resources, whether competitive markets for natural resources establish prices which correspond to the actual social value of the resource, and whether differences between market prices and social values can be estimated. An intensive review of the literature of resource economics uncovers widespread disagreement with the classic Hotelling model, in which the optimal price of a resource is treated as the sum of the lease value and the marginal social cost of extraction, and in which market forces are assumed to be in neutralizing equilibrium. Market forces for which price effects can be estimated show little distortion between actual and optimal prices.However, market forces act in varying directions and with varying intensity over time. It is also difficult to measure the magnitude or even the direction of bias given to the prices acting on supply and demand. Finally, the socially optimal level of resource depletion and conservation is likely to be viewed differently from one generation to another. (Harris-Wisconsin)
W79-08810

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE CAPITAL COSTS OF INDUSTRIAL POLLUTION CONTROL,
De La Rue (Robert E.) Associates, Santa Clara, CA.
R. E. De La Rue, and E. A. De La Rue.
Pollution Engineering, Vol. 10, No. 12, p 47-52, December 1978. 5 tab.

Descriptors: *Capital costs, *Water pollution control, *Air pollution, *Solid wastes, *Economics, *Industrial wastes, *Regulation, Waste treatment, Waste disposal, Industries, Utilities, Forecasting, Pollution abatement, Energy, Oil industry, Metals, Chemical industry, Pulp and paper industry, Costs.

Industry's cost of pollution control facilities rose from $2.5 billion (3.1% of total capital expenditures) in 1970 to $6.9 billion (5.1%) in 1977 in response to increasing regulation by the U.S. Environmental Protection Agency and local agencies. Air pollution control is still the largest area of spending, rising from $1.2 billion in 1970 to $3.7 billion in 1977 (202% increase); water pollution control costs increased from $1.1 billion to $2.8 billion (145% increase), and solid waste disposal from $112 million to $462 million (313% increase). Pollution control expenditures in 1977 for certain industries were: utilities, $2.3 billion; petroleum, $1.2 billion; primary metals, $0.9 billion; chemicals, $0.7 billion; paper, $0.4 billion; and machinery, and transportation equipment, $0.4 billion. These six accounted for 85% of the $6.94 billion capital expenditure for pollution control by all industries in 1977. Utilities accounted for the largest portion of industrial capital expenditures for all three types of pollution control: air pollution, $1.53 billion (41%), water pollution, $0.65 billion (23%); and solid waste disposal, $0.12 billion (26%). Forecasts for 1978, 1982, and 1985 show that capital expenditures for pollution control will reach $11.6 billion by 1985, with $5.7 billion for air pollution, $5.1 billion for water pollution, and $0.9 billion for solid wastes. Capital expenditures accounted for by pollution control will rise ro 6.7% in 1978 but decline to 5.2% by 1985. (Lynch-Wisconsin)
W79-08801

THE OPTIMAL EXPLOITATION OF RENEWABLE RESOURCE STOCKS: PROBLEMS OF IRREVERSIBLE INVESTMENT,
British Columbia Univ., Vancouver.
C. W. Clark, F. H. Clarke, and G. R. Munro.
Econometrica, Vol. 47, No. 1, p 25-47, January 1979. 4 fig, 19 ref.

Descriptors: *Economics, *Capital, *Investment, *Natural resources, *Renewable resources, *Commercial fishing, Mathematical models, Model studies, Nonmalleable capital, Irreversibility, Policy, Common property, Optimization, Fisheries, Resource exploitation, Financing.

Although long-term optimal sustained yield of resources is unaffected by capital investment irreversibility, short-run dynamic behavior may be significantly affected unless capital is perfectly nonmalleable with profound implications for rehabilitating overexploited fisheries or other renewable resource stocks. A new fishery has a short-run phase in which only operating costs are relevant to the management decision. In policy terms, this study supports the accepted belief that in initial development of a common-property resource excessive capitalization is likely to occur, but extreme stock rehabilitation policies such as fishing moratoria may be unwarranted unless the stock is severely depleted. The less that capital assets are transferrable the more important this consideration becomes. Previous studies of the economics of renewable resources have explicitly or implicitly assumed that capital stocks are perfectly malleable. Assuming nonmalleability complicates the optimization problem since a minimum of two state variables are then involved. A model associated with Gordon and Schaefer was employed in the analysis, geared specifically to commercial fishing. (Lynch-Wisconsin)

W79-08802

MARKETABLE EFFLUENT PERMITS FOR THE CONTROL OF PHOSPHORUS INFLUENT INTO LAKE MICHIGAN,
Wisconsin Univ.-Madison. Social Systems Research Inst.
M. David, W. Eheart, E. Joeres, and E. David.
Social Systems Research Institute Workshop Series 7716, December 1977. 35 p, 1 fig, 1 tab, 14 ref.

Descriptors: *Permits, *Pollution abatement, *Pollution taxes(Charges), *Lake Michigan, *Wisconsin, *Point sources, *Costs, Water pollution control, Regulation, Legislation, Legal aspects, Water law, Non-structural alternatives, Eutrophication, Waste water treatment, Eutrophication, Waste water treatment, Waste treatment, Phosphorus, Water Pollution Control Act Amendments of 1972(PL 92-500), Effluents, Cost sharing, Economics.

A description of how a system of marketable effluent permits (MEP) can be implemented to achieve desired pollution abatement levels also pinpoints segments of the public likely to derive the most benefit from such permits and illustrates a mechanism for assuring equitable sharing of abatement costs. A general argument for applying MEP in any situation involving abatement of conservative pollutants discharged into stratified bodies of water is illustrated by discussion of the Lake Michigan basin; an MEP system is proposed for Wisconsin in which permits valid for five years (the longest allowed by federal regulations) would use MEP rights as substitutes for changes in plant operations between dates of major operational alterations. The Wisconsin plan for Lake Michigan MEP abatement would have five administrative features: (1) All point sources into the lake basin would be required to own MEPs equal to the amount of phosphorus emitted to the lake. (2) The penalty for exceeding permitted emission levels would be a large daily fine, greater by several magnitudes than the cost of the MEPs. (3) The Wisconsin Department of Natural Resources (DNR) would annually assess total phosphorus load that may be emitted to the lake from point sources. (4) DNR would allocated MEPs to the various basin communities so as to assure that overall loading would not be exceeded. (5) Communities with excess MEPs could sell them to localities with MEP deficiencies; the exchange would reallocate the phosphorus load so as to make best of the resources of the basin. (Harris-Wisconsin)
W79-08809

EVALUATION OF ECONOMIC BENEFITS OF RESOURCE CONSERVATION,
Environmental Law Inst., Washington, DC.
For primary bibliographic entry see Field 6B.
W79-08810

6D. Water Demand

ANALYSIS OF WATER USE IN THE KROKODIL RIVER SYSTEM,
Department of Forestry, Pretoria (South Africa).
D. W. van der Zel.
South African Forestry Journal, No. 103, p 8-14, December 1977. Presented at the Annual Congress of the South African Association for the Advancement of Science, Nelspruit, August 1976. 2 fig, 3 tab, 8 ref.

Descriptors: *Water utilization, *Rivers, River systems, Water management(Applied), Water resources development, Water consumption(Except consumptive use), Consumptive use, Krokodil River, South Africa, Natural use, Natural resources, Water distribution(Applied), Ecosystems.

Water use in the biosystem of the Krokodil River in the Eastern Transvaal is examined. The catchment covers 10,526 sq km of broken and mountainous land. The biosystem consists of three main areas: (1) a cool, moist, pastural highveld, (2) a cool, wet, forrested escarpment zone, and (3) a hot, dry lowveld with subtropical vegetation. The biosystem was broken into eleven subsystems for purposes of analysis and identification. Annual rainfall for the biosystem totaled 9,077.7 million cu m; annual water importation from the neighboring Komati River totaled 3.3 million cu m. Total water use for the 58,590 ha under irrigation was 911.9 million cu m, or 479.7 million cu m more than under the natural situation. An additional 1,380.8 million cu m was used for the 144,360 ha under plantations. About 13.4 million cu m more water was used by dry lands (31,458 ha) than was used by the natural bush it replaced. Separate water use estimates given for the eleven subsystems should be correct to within about 10%. Two possibilities exist for improving on the scarcity of water: more efficient management of present water applications, and more efficient management of land for the specific purpose of water production. The former includes substituting concrete irrigation pipe lines for open earth furrows, regular thinning and pruning of tree stands, timing of clearfellings, and careful scheduling of irrigation. (Schaefer-IPA)
W79-08501

INVESTING IN WATER,
Water, No. 25, p 17-20, March 1979. 2 fig.

Descriptors: *Water supply, *Loans, *Financing, England, France, Italy, European investment bank, Reservoir construction, Economics, Water resources development, Irrigation programs, Water pollution control, European economic community.

An examination by the European Investment Bank (EIB) of the ways the more than 675 million pounds sterling loaned by the bank to the water industry has been spent is presented. Between 1970 and 2000, fresh water consumption in the European Economic Community (EEC) is expected to rise by about 60%. A high level of investment is needed to ensure adequate water supplies. Loans have been used for water supply schemes, irrigation, and sewerage/antipollution projects; two-fifths of the EIB money has gone to the United Kingdom. The EIB, under the treaty of Rome, channels finance into projects assisting regional development and assists projects of common interest to several member states of the EEC as a whole. A major anti-pollution project for the Rhine is one example. Italy has benefited from EIB financing; projects financed have improved the conditions for attracting both large and small industrial ventures. In Italy, the Pertusillo aqueduct, the Monte Cotugno reservoir, irrigation schemes, and a huge anti-pollution project in the Bay of Naples were financed by EIB. France has received money for the latter. In the United Kingdom, money has gone to water supply and sewerage works; these are detailed. (Schaefer-IPA)
W79-08588

THE MOSAIC THAT TURNED INTO A UNIFIED INDUSTRY,
C. D. Andrews.
Water, No. 25, p 24-28, March 1979. 5 fig.

Descriptors: *Water supply, *Water policy, *Water resources, England, Water resources development, Waste water disposal, Water quality control, Water distribution(Applied), Management, Administrative agencies, National Water Council, National Water Authority.

The water industry in England and Wales is surveyed since its reorganization in 1974. In that year the 1,600 separate authorities that administered water services in England and that had not yet been amalgamated were reorganized into ten multipurpose regional water authorities. They were responsible for the integrated development and management of every aspect of the hydrological cycle: water resources; water distribution and supply; sewerage and sewage treatment; the prevention of pollution; river management; land drainage; flood protection and sea defenses; recreation; fisheries; and in some cases navigation. The National Water Council (NWC) provides a central co-ordinating, consultative, and advisory service. Further reorganization would replace the NWC with a National Water Authority and would incorporate research, planning, and data units. The supply of water, resources behind the supply, disposal of waste water, quality control, the distribution network, and land drainage, agriculture, fisheries, recreation, and amenities are discussed. Manpower, personnel problems, and expenditures are reported. Theoretically, the level of service depends on the customers' readiness to pay for those services; in practice, most authorities feel they are rendering good service for a good price, while most customers feel they could run the show better themselves. (Schaefer-IPA)
W79-08589

WATER IN MISSOURI,
Department of Natural Resources, Jefferson City, MO. Div. of Geology and Land Survey.
For primary bibliographic entry see Field 2A.
W79-08613

6E. Water Law and Institutions

PROCEDURES FOR COMPLYING WITH EXECUTIVE ORDER 11988 ON FLOODPLAIN MANAGEMENT AND EXECUTIVE ORDER 11990 ON PROTECTION OF WETLANDS,
Department of Agriculture, Washington, DC.
Federal Register, Vol. 43, No. 112, p 25322-25324, Friday, June 9, 1978.

Descriptors: *Flood plains, *Wetlands, *Protection, *Legal aspects, United States.

Agencies of the Department of Agriculture are developing policies and procedures for complying with Executive Order 11988 and Executive Order 11990. The Department of Agriculture hereby gives notice of its proposed policy for compliance with the two Executive Orders. (Stihler-Mass)
W79-08542

PROCEEDINGS OF THE WATER PLANNING WORKSHOP 1978 HELD IN MELBOURNE, 29-30 MARCH 1978,
Workshop held under the auspices of the Department of National Development, Australian Water Resources Council. 1978. Australian Government Publishing Service, Canberra.

Descriptors: *Water resources, *Planning, *Water policy, Australia, Workshops, Publications, Water management(Applied), Water demand, Water reuse, Baseline studies, Water conservation.

The overall objective of the Water Planning Workshop was to examine water resources planning principles in Australia, without undue bias towards planning procedures used in the U.S. Proceedings of the workshop, including summaries of the findings of syndicate sessions are presented. Also included are a copy of the keynote address, a background paper for the workshop, and copies of all papers presented at address sessions of the workshop. The program was divided into two areas: a review and analysis of current water planning in Australia, and development of desirable approaches. Each area was divided into three sessions: an introduction, a discussion, and a presentation of reports. It was agreed that improvements were needed on current planning methods; financial, environmental, administrative, and legal aspects should be considered early in the planning process. Planning should be more flexible and responsive to changing conditions, uncertainty and public needs, priorities, and aspirations. A strong need was seen for a public education program in the area. A key area for immediate action was the deficiencies in baseline data relating to other disciplines in comparison to water resources data. Some principles and guidelines developed by syndicate groups of the workshop are presented. (Schaefer-IPA)
W79-08602

ADVANCES IN GROUNDWATER HYDROLOGY.
For primary bibliographic entry see Field 2F

W79-08631

DEVELOPMENTS IN GROUNDWATER LAW,
Wyoming Univ., Laramie. Coll. of Law.
F. J. Trelease.
In: Advances in Groundwater Hydrology; Proceedings of Symposium held at Chicago, Illinois, 1976. American Water Resources Association, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, p 271-278, September 1976. 27 ref

Descriptors: *Water law, *Groundwater, *Water rights, Legal aspects, Legislation, Groundwater law.

Groundwater law has changed its form a number of times in the past and will continue to develop in the future. Originally, rules of ownership gave a free hand to developers and settled squabbles between neighbors. Later, rules of reasonable use protected rural users from withdrawals by cities and forced the cities to pay for harm done. Then, prior appropriation and other methods of limiting new uses and withdrawals were adopted. These rules have been used to solve the problems of lowered water tables and artesian pressure, maintaining a 'safe yield', groundwater mining and correlation of groundwaters and streams. Recent developments noted include statutes limiting withdrawals to recharge in Idaho, South Dakota, and Montana; Virginia's new prior appropriation law; the new Nebraska state controls; and Oklahoma's new property rules. The latest phase of Arizona's problems was discussed. As new controls and new institutions are needed, and as those needs become pressing, the law will continue to evolve and change to meet those needs and fulfill them. (See also W79-08631) (Humphreys-ISWS)
W79-08652

REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1978 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
G. L. Ducret, Jr.
Geological Survey open-file report 79-422, 1979. 25 p, 1 fig, 3 tab, 3 ref.

Descriptors: *Interstate compacts, *Interstate rivers, *Arkansas, *Oklahoma, *Streamflow, Flow rates, Gaging stations, Water yield, Runoff, Reservoir storage, *Arkansas River basin.

This report contains computed annual yields and deficiencies of the subbasins as defined in the Arkansas River Compact, Arkansas-Oklahoma; actual runoff from the subbasins and depletion caused by major reservoirs in the compact area; and monthly, maximum, minimum, and mean discharges for the 14 streamflow stations used in computing annual yield. (Woodard-USGS)
W79-08685

THE IMPACT OF THE SEWER CONNECTION BAN ON BIOCHEMICAL OXYGEN DEMAND AND SUSPENDED SOLIDS AT THE NORTH SHORE SANITARY DISTRICT,
N. Drummond, and R. D. Letterman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 688, Price codes: A04 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality Document No. 72-4, 1972. 47 p, 17 fig, 24 tab, 14 ref, 2 append.

Descriptors: *Municipal wastes, *Legal aspects, *Law enforcement, *Sewerage, *Treatment facilities, State governments, Suspended solids, Biochemical oxygen demand, Performance, Growth rates.

The impact of normal growth on the receiving waters was investigated for the North Shore Sanitary District. Trends in operating efficiency are projected based on estimates of population growth. If treatment facilities are not upgraded, increases in population in the Clavey Road Treatment Plant area would increase the effluent BOD concentration from 46 to 48 mg/liter. Suspended solids would increase from 47 to 49 mg/liter. Effluent BOD concentration at the Waukegan Plan would increase from 61 to 67 mg/liter and suspended solids would increase from 43 to 45. These increases are for the period from 1972 to 1974. Because the plants were overloaded before the enactment of a sewer connection ban, the effects of the ban have not been significant. Upgrading of the plants would more than offset the increases in BOD and suspended solids that result from new sewer connections during two years of normal growth. (Small-FRC)
W79-08764

NOTES ON THE SYMMETRY OF TAXES AND SUBSIDIES IN POLLUTION CONTROL,
Harvard Univ., Cambridge, MA.
For primary bibliographic entry see Field 6B.
W79-08803

ECONOMIC IMPACT OF REVISIONS OF THE PUBLIC WATER SUPPLY REGULATIONS, R77-13,
Northwestern Univ., Evanston, IL. Dept. of Civil Engineering.
R. S. Gemmell, and T. D. Waite.
Illinois Institute for Environmental Quality, Document No. 78-09, May 1978. 41 p, 10 ref, 5 append. 80.118.

Descriptors: *Illinois, *Water supply, *Regulation, *Economic impact, *Water quality standards, Cost-benefit analysis, Iron, Manganese, Safe Drinking Water Act, Grants, Illinois Pollution Control Board, Illinois Environmental Protection Agency, Odor, Color, Foaming, Copper, Zinc, Water treatment, Environmental effects, Public health.

Changes in the rules and regulations of the Illinois Pollution Control Board dealing with public water supplies (R77-13), proposed by the Illinois Environmental Protection Agency, will comply with provisions of the Federal Safe Drinking Act and Drinking Water Regulations. Compliance with the federal regulations will mean eligibility for federal grants under the State Public Water System Supervision Program, amounting to about $0.9 million. Savings due to avoidance of iron and manganese treatment costs are estimated at $14.2 million. Other proposed changes involve deletions of maximum allowable concentrations of ten substances affecting the aesthetic quality of water, in order to relieve 491 public water supplies of the necessity of making expensive improvements in their treatment facilities. Effects on health and the environment will be minimal, but aesthetic quality of the water may deteriorate somewhat. Deleted standards are those for odor, color, foaming agents, copper, iron, manganese, and zinc. No effects are foreseen on agriculture or on goods and services, though employment availability and industry will be affected somewhat. (Lynch-Wisconsin)
W79-08806

6F. Nonstructural Alternatives

URBAN RUNOFF TREATMENT METHODS. VOLUME I - NON-STRUCTURAL WETLAND TREATMENT,
Hickok (Eugene A.) and Associates, Wayzata, MN.
E. A. Hickok, M. C. Hannaman, and N. C. Wenck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 172, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-217, 1977. 131 p, 41 fig, 15 tab, 28 ref, 4 append.

Descriptors: *Wetlands, *Storm water, *Urban runoff, *Non-structural alternatives, *Water management(Applied), *Nutrient removal, Water quality control, Phosphorus, Suspended solids, Soil texture, Storm runoff, Municipal wastes, Watershed management, Minnesota.

The detrimental effects of stormwater runoff in the Minnehaha Creek Watershed District in Minnesota, leading to reduced water quality in Lake Minnetonka, may be alleviated by utilization to adjacent wetlands. The non-structural use of wetlands for the retention of phosphorus and suspended solids from urban runoff has been demonstrated as a feasible means of controlling runoff and water quality; the renovation of the stormwater runoff in the wetland occurred by a combination of physical entrapment, microbial transformation, and biological utilization. The wetlands studied has a phosphorus retention capacity about 5.5-times that of soil and retained 77% of all phosphorus and 94% of the total suspended solids entering the site. The physical entrapment of contaminants was attributed to the fine texture of the wetland soil, which is also responsible for reducing the velocity of the groundwater movement. The non-structural use of the wetland for controlling urban runoff had no apparent impacts on the wildlife or vegetation in the area. (Lisk-FRC)
W79-08773

6G. Ecologic Impact Of Water Development

THE POST-IMPOUNDMENT ICHTHYOFAUNA OF THE J. G. STRIJDOM DAM, KWAZULU,
Natal Univ., Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 2H.
W79-08521

ESTUARINE PROCESSES, VOLUME I AND II.
For primary bibliographic entry see Field 2L.
W79-08543

7. RESOURCES DATA

7A. Network Design

ECOLOGICAL INVESTIGATION OF DAMS IN THE UMFOLOZI GAME RESERVE,
Natal Parks Board, Pietermaritzburg (South Africa). Hluhluwe Game Reserve.
R. N. Porter.
Public Works Construction and Transport, p 15-16, April 1978. Presented at a meeting of the South African Institution of Civil Engineers, February 28, 1978. 13 ref.

Descriptors: *Ecosystems, *Network design, *Damsites, National wildlife refuges, Environment, Habitats, Wildlife, On-site data collections, Investigations, Dams, Evaluations, Umfolozi Game Reserve, South Africa, Civil engineering.

An investigation of the environmental impacts of proposed dams in the Umfolozi River Basin is presented. The Umfolozi is the largest river in northern Natal and Zululand, and one of the few major river systems in South Africa in which no significant development has yet been undertaken. Initially, 39 possible dam sites were recognized; after further investigations, a provisional list of 12 possible sites was determined. Six sites are situated to the west of the Umfolozi Game Reserve, two lie to the east of it, and four are within it. The catchment measures 11,330 sq km of the 47,753 ha reserve. Ten different major woody plant communities have been recognized, as well as 48 species of mammals, 37 species of reptiles, 10 species of fish, 9 species of amphibia, and 336 species of birds in the reserve. A matrix approach was adopted for the environmental impact assessment; existing land use activities will be mapped and categorized. Identification of 30 different engineering actions and 36 environmental concern variables gave a possible total of 1,080 interactions. The final matrix for each dam site will be prepared by a small multidisciplinary group; it will then be submitted to a larger group of specialists for independent completion. The approach will be multi-judgmental and will reflect, as far as possible, an unbiased evaluation. (Schaefer-IPA)
W79-08522

7B. Data Acquisition

ESTUARINE PROCESSES, VOLUME I AND II.
For primary bibliographic entry see Field 2L.
W79-08543

SNOWPACK GROUND TRUTH, DONNER PASS SITE, SODA SPRINGS, CALIFORNIA, JANUARY 18, 1977,
Bittinger (M.W.) and Associates, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 2C.
W79-08548

A TECHNIQUE FOR THE DIRECT MEASUREMENT OF WATER STORAGE ON A FOREST CANOPY,
University of Strathclyde, Glasgow (Scotland). Dept. of Applied Physics.
For primary bibliographic entry see Field 2B.
W79-08577

USE OF INDICES OF DIVERSITY AND HIERARCHICAL DIVERSITY IN STREAM SURVEYS,
Kansas Univ., Lawrence. Dept. of Geology.
R. L. Kaesler, E. E. Herricks, and J. S. Crossman.
Biological Data in Water Pollution Assessment; Quantitative and Statistical Analyses, American Society for Testing and Materials Special Technical Publication 652, K. L. Dickson, J. Cairns, Jr., and R. J. Livingston, Eds., p 92-112, 1978. 6 fig, 15 tab, 35 ref.

Descriptors: *Aquatic environment, *Streams, *Surveys, Species, Diversification, Brillouin's equation, Hierarchical diversities, Ecosystems, Data collections, On-site data collections, Indicators.

Indices of species diversity from information theory, the biological theory behind their use, some practical applications, and their potential for contributing to the ultimate goal of reducing the cost and time-lag of biological surveys of the aquatic environment are examined. Brillouin's equation (H) is shown to provide greater insight into the structure of communities, particularly those from stressed environments, than other indices; it is more sensitive to low diversities and is not biased. Use of small replicated samples to study species diversities is likely to be more productive than use of a single species diversity computed from a larger sample. Generic level diversities may provide almost as much information about community studies as species diversity, and consequently could save time and money. The ability to partition diversities hierarchically is not confined to taxonomic hierarchies. Hierarchical diversities based on trophic-group analysis and functional morphological clssifications are shown to hold promise for applied aquatic ecology. (Schaefer-IPA)
W79-08596

FIELD MANUAL FOR RESEARCH IN AGRICULTURAL HYDROLOGY.
Science and Education Administration, Washington, DC.
Agriculture Handbook No. 224. Revised February 1979. D. L. Brakensiek, H. B. Osborn, and W. J. Rawls, Coordinators. 554 p, 355 fig, 49 tab, 291 ref, 3 append.

Descriptors: *Hydrologic data, *Projects, *Research and development, Data collections, Research equipment, Research facilities, Agriculture, Data processing, On-site investigations, On-site data collections, Publications.

A complete set of techniques for the initiation and maintenance of hydrologic research projects is presented. Techniques were solicited from experts and adapted from material described in current literature. The field manual is not intended to replace individual instruction by an experienced person, but is to serve as a reference for such instruction. If followed, the manual will allow the user to place the data in a form that will be suitable for potential analyses. The best ways to organize and record data are illustrated by forms. The six chapters deal with precipitation, runoff, climate, sedimentology, geology, and watershed characteristics and soil moisture. Each subject is divided into information regarding installations, field observations/maintenance, data reduction, and data processing. (Schaefer-IPA)
W79-08598

THEMATIC MAPPING, LAND USE, GEOLOGICAL STRUCTURE AND WATER RESOURCES IN CENTRAL SPAIN.
Instituto Geografico y Catastral, Madrid (Spain).
Available from the National Technical Information Service, Springfield, VA 22161 as E77-10167, Price codes: A15 in paper copy, A01 in microfiche. Final Report, November 1976. 332 p. NASA 28760.

Descriptors: *Remote sensing, *Satellites(Artificial), *Foreign research, Mapping, Data processing, Land use, Soils, Forests, Forestry, Geology, Geomorphology, Water resources, *Spain, LANDSAT.

This final report was submitted to NASA as result of one year of investigations carried out in multidisciplinary mode by the participant organizations for the purpose of studying applications of LANDSAT-2 data to several scientific fields in central Spain. This project involved the participation of various official agencies and working groups related to the problem of surveying the earth surface for their own scientific application. Instituto Geografico y Catastral is the agency that holds the coordinative function in Project No. 28760, with the contribution of 7 other organizations. The items of investigation studied were the following: (1) cartography, (2) digital processing, (3) edaphology, (4) forestry, (5) geology, (6) geomorphology, (7) land use, (8) remote sensing techniques, and (9) water resources. As the general objective was defined, the research in various disciplines by means of LANDSAT-2 data taken over central Spain was for the purpose of developing an operational methodology able to contemplate future space programs as a valuable working tool in the knowledge of the earch disciplines. Every working group has conducted the investigation applied to his own area of interest, but all the participant organizations have the benefit of an exchange of know-how and continuous contact between their scientific personnel. Furthermore, the techniques and equipment available have been exploited in common. (Sims-ISWS)
W79-08608

CHEMICAL COAGULATION DOSAGE CONTROL,
Civil and Environmental Engineering Development Office, Tyndall AFB, FL. Detachment 1 (ADTC).
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 388, Price codes: A03 in paper copy, A01 in microfiche. Report CEEDO-TR-76-44, 1976. 28 p, 4 fig, 4 tab, 31 ref.

Descriptors: *Coagulation, *Water quality, *Analytical techniques, *Indicators, *Zeta potential, Turbidity, Chemical oxygen demand, Electrophoresis, Water quality control, Waste water treatment, Municipal wastes, Water treatments, Polyelectrolytes.

A control procedure for determining the best coagulant dosage based on certain water quality indicators was investigated utilizing secondary waste water effluent and raw water. The coagulants studied were aluminum sulfate, ferric chloride, ferric sulfate, sodium aluminate, a cationic polyelectrolyte, two anionic polyelectrolytes, and two nonionic polyelectrolytes. The indicators used included zeta potential, colloidal titration, apparent color, true color, COD reduction, turbidity reduction, and bacteriophage reduction. The method of isoelectric point location of titration was compared with the electrophoretic mobility method; both methods were compared with observed best coagulant dosages for physical and bacteriophage tests. Results of the study indicated that the colloidal titration technique and electrophoretic mobility methods did not always produce correlative data. Neither method of isoelectric point location corresponded well with the best coagulant dosage for the physical and biological indicator parameters. The best dosage for turbidity reduction was not the same as the best dose for bacteriophage removal, and hence, turbidity and isoelectric point should be considered approximate methods for calculating coagulant dosages. Further research in this area of study was considered necessary. (Lisk-FRC)
W79-08740

COMPARISON OF DIFFERENT METHODS FOR MEASURING SOIL SALINITY UNDER FIELD CONDITIONS,
Indian Agricultural Research Inst., New Delhi. Water Technology Center.
B. R. Yadav, N. H. Rao, K. V. Paliwal, and P. B. S. Sarma.
Soil Science, Vol. 127, No. 6, p 335-339, June 1979. 1 fig, 1 tab, 16 ref.

Descriptors: *Saline soils, *Salinity, *Measurement, Instrumentation, Sampling, Conductivity, Root zone, Statistical methods, Regression analysis, Salinity sensor, Pressure vacuum cup, Saturation extract method.

Soil salinities measured by salinity sensor (EC sub s), pressure vacuum cup (EC sub p), and bulk soil conductivity (EC sub a) were compared with those measurements obtained by the saturation extract method (EC sub e) in a field experiment. There was a significant correlation between EC sub a, EC sub s, and EC sub p, each with EC sub e. The soil resistivity method appears to be quite appropriate for surveying large tracts of salt-affected soils using these regression equations. (Visocky-ISWS)
W79-08757

IMPROVEMENTS FOR KRAFT PULP AND MUNICIPAL TREATMENT PROCESSES,
Envirotech Corp., Menlo Park, CA.
For primary bibliographic entry see Field 5D.
W79-08789

PROPERTIES OF AN AQUATIC MICRO-ECOSYSTEM: I. GENERAL INTRODUCTION TO THE PROTOTYPES,
Amsterdam Univ., (Netherlands). Limnology Lab.
For primary bibliographic entry see Field 5C.
W79-08816

7C. Evaluation, Processing and Publication

AQUIFER TRANSMISSIVITY FROM SURFICIAL ELECTRICAL METHODS,
Illinois State Geological Survey, Urbana.
P. C. Heigold, R. H. Gilkeson, K. Cartwright, and P. C. Reed.
Groundwater, Vol. 17, No. 4, p 338-345, July-August 1979. 7 fig, 2 tab, 15 ref.

Descriptors: *Transmissivity, *Glacial aquifers, *Resistivity, *Illinois, Geophysics, Electrical studies, Hydraulic conductivity, Darcys law, Permeability, On-site investigations, Particle size, Aquifer characteristics, Aquifer testing, Glacial sediments.

Recent advances in the automatic inversion of vertical electrical sounding data offer the opportunity to describe the relationship of the resistivity of a granular aquifer to its hydraulic conductivity. This type of relationship, together with aquifer thickness, can be used to determine the transmissivity of the aquifer. Vertical electrical soundings and pump-test data along the axis of a glacial outwash aquifer in central Illinois have indicated an inverse relationship between aquifer resistivity and hydraulic conductivity. This relationship has been attributed to differences in sorting of the outwash sediments. But studies of granular aquifers deposited in other geologic environments are

needed before meaningful generalizations can be made. (Visocky-ISWS)
W79-08623

RELATIONSHIP BETWEEN SUMMER MEAN AND MAXIMUM CHLOROPHYLL A CONCENTRATIONS IN LAKES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W79-08628

SUMMARY OF HYDROLOGIC DATA COLLECTED DURING 1977 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Hull.
Geological Survey open-file report 79-514, 1979. 91 p, 59 fig, 8 tab, 18 ref.

Descriptors: *Hydrologic data, *Streamflow, *Groundwater, *Canals, *Water quality, Water supply, Water utilization, Aquifers, Water wells, Water levels, Water yield, Saline water intrusion, Chemical analysis, Nutrients, Radiochemical analysis, Pesticides, *Dade County(FL).

During 1977 rainfall was 1.52 inches above the long-term average in Dade County, Fla. Groundwater levels ranged from 0.3 foot above to 0.1 foot below average. The highest and lowest groundwater levels for the year were 1 foot below and 1 foot above their long-term average. In the Hialeah-Miami Springs area, water levels in wells near the centers of the heaviest pumping ranged from 7.2 to 11.9 feet below mean sea level, 1929; and in the Southwest well-field area, ground-water levels near the centers of pumping ranged from 1.0 foot above to 1.5 feet below mean sea level. In 1977 the combined average daily discharge from nine major streams and canals that flow eastward into tidal waters was 1,712 cubic feet per second (cfs), 46 cfs above the combined average daily flow for 1976. The combined average daily flow through the Tamiami Canal outlets was 582 cfs, 201 cfs above that of 1976. The 1977 position of the salt front in the coastal part of the Biscayne aquifer was about the same as in 1976, except south of Homestead Air Force Base where the salt front had encroached farther inland. (Woodard-USGS)
W79-08686

MAP SHOWING GROUND-WATER CONDITIONS IN THE KAIBITO AND TUBA CITY AREAS, COCONINO AND NAVAJO COUNTIES, ARIZONA--1978,
Geological Survey, Tucson, AZ. Water Resources Div.
C. D. Farrar.
Geological Survey Water-Resources Investigations 79-58 (open-file report), March 1979. 1 sheet, 11 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water wells, *Water levels, *Water quality, Hydrogeology, Maps, Groundwater availability, Water yield, Water analysis, Dissolved solids, Fluorides, Arizona, *Coconino County(Ariz), *Navajo County(Ariz).

The Kaibito and Tuba City areas include about 2,500 square miles in north-central Arizona. Ground water is obtained from the N aquifer and from alluvium. The N aquifer consists of Navajo Sandstone, Kayenta Formation, Moenave Formation, and the Lukachukai Member of the Wingate Sandstone. The main source of ground water is the Navajo Sandstone. Ground-water development has been slight in the areas. In 1977 the estimated ground-water withdrawals were about 350 acre-feet in the Kaibito area and 650 acre-feet in the Tuba City area. Water levels ranged from flowing at the land surface to 1,360 feet below the land surface. The chemical quality of the water in the N aquifer does not vary greatly in the areas. Dissolved-solids concentrations in the water range from 101 to 669 milligrams per liter but generally are less than 300 milligrams per liter. Along some of the valleys in the Kaibito and Tuba City areas, the alluvium yields water to many shallow dug wells. The water levels generally are from 5 to 15 feet below the land surface. Dissolved-solids concentrations in water from the alluvium usually are less than 600 milligrams per liter. Information shown on the map (scale 1:125,000) includes depth to water, altitude of the water level, and specific conductance and fluoride concentrations. (Woodard-USGS)
W79-08688

MAP SHOWING GROUND-WATER CONDITIONS IN THE VIRGIN RIVER, GRAND WASH, AND SHIVWITS AREAS, MOHAVE COUNTY, ARIZONA--1976,
Geological Survey, Tucson, AZ. Water Resources Div.
G. W. Levings, and C. D. Farrar.
Geological Survey Water-Resources Investigations 79-57 (open-file report), March 1979. 1 sheet, 8 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water wells, *Water levels, *Water quality, Hydrogeology, Maps, Groundwater availability, Water yield, Water analysis, Dissolved solids, Fluorides, Arizona, *Mohave County(Ariz).

The Virgin River, Grand Wash, and Shivwits areas include about 3,250 square miles in northwestern Arizona. Ground water is obtained mainly from the alluvium, conglomerate, and basalt; however, several other formations yield small amounts of water to some wells. In the Virgin River area, most wells are less than 200 feet deep, water levels range from 17 to 310 feet below the land surface, and well yields range from a few gallons per minute to as much as 2,000 gallons per minute. Springs in the Littlefield area contribute about 70 cubic feet per second of water to the Virgin River. In the Grand Wash area wells are from 35 to 850 feet deep, and water levels range from 5 to 759 feet below the land surface. In the Shivwits area wells are from 10.5 to 300 feet deep, and water levels range from 10 to 256 feet below the land surface. The chemical quality of the water varies with location and aquifer in the report area. Information shown on the map (scale 1:125,000) includes the principal aquifer that furnishes water to wells and springs, depth to water, altitude of the water level, and specific conductance and fluoride concentrations. (Woodard-USGS)
W79-08689

WATER RESOURCES DATA FOR CONNECTICUT, WATER YEAR 1977.
Geological Survey, Hartford, CT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 400, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CT-77-1, February 1979. 383 p, 4 fig.

Descriptors: *Connecticut, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Connecticut consist of records of stage, discharge, and water quality of streams; contents and water quality of lakes and reservoirs; and water levels and water quality in wells. This report contains discharge records for 50 gaging stations; tidal volume for 1 gaging station; stage only records for 3 tidal-gaging stations; contents for 36 lakes and reservoirs; water quality for 56 gaging stations, 3 lakes, 28 wells, 4 springs, 4 seepage sites, and 1 chemical precipitation station; and water levels for 21 observation wells. Also included are 44 crest-stage partial-record stations and 38 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Connecticut. (Woodard-USGS)
W79-08690

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1977,
Geological Survey, Boise, ID. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 545, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ID-77-1, February 1979. 640 p, 21 fig.

Descriptors: *Idaho, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 190 gaging stations; stage only records for 2 gaging stations; stage for 6 lakes; contents for 24 lakes and reservoirs; water-quality for 95 gaging stations, 76 partial-record stations, and 287 wells; and water levels for 6 observation wells. Also included are data for 57 crest-stage partial-record stations and 187 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (Woodard-USGS)
W79-08696

8. ENGINEERING WORKS

8A. Structures

MURRAY AND STEWART MEETING TIGHT DEADLINES AT STEENBRAS.
The Civil Engineering Contractor, Vol. 11, No. 9, p 15-18, June 1977. 5 fig.

Descriptors: *Dam construction, *Steenbras Pumped Storage Scheme, Dams, Dam design, Construction, Dam foundations, Excavation, Structures, Concrete dams, Electric power production, Hydroelectric plants, South Africa.

The construction of the Steenbras Pumped Storage Scheme and the performance of the main contractor Murray and Stewart are examined. The project promotes electricity for peak periods by allowing water to drop from a high level dam through a tunnel and surge shaft to turbines lower down. The water will be pumped back in the off-peaks when there is a surplus of cheap electricity. Savage and Lovemore, one of the two specialist subcontractors, are responsible for the roads, the newly completed high-level dam, and the low-level dam. RUC Mining Contracting Company is responsible for the excavation of machine shafts in the main power station, the 5 m diameter tunnels, and the surge shaft. The kilometer long tunnel linking the upper and lower dams has three sections: the low pressure tunnel, the vertical surge shaft, and the high pressure tunnel. The 20 meter diameter machine shafts had to be lined with 50 mm of concrete for 37 meters of their 49 meter depth. The shafts could not be lined during excavation so a system was devised to handle placing the lining against a variable rockface with dubious anchorage. Excavations at the power station had to be blasted to a tolerance of 15 centimeters. The project will cost about R41-million at 1974 prices; completion is expected in late 1978. Capacity of the 35 hectare dam will be two million cubic meters of water. (Schaefer-IPA)
W79-08507

A TIGHT SCHEDULE AND A FLASH FLOOD.
Construction in Southern Africa, Vol. 22, No. 3, p 24-27, June 1977. 5 fig.

Descriptors: *Umtata Dam, *Dam construction, Umtata River, South Africa, Dams, Construction, Dam design, Excavation, Earth dams, Spillways, Engineering structures, Embankments, Flash floods.

The construction of the R 5.5 million Umtata Dam is examined. Preliminary and engineering designs were drawn for the Transkei Government early in 1976. Work on site was begun by Grinaker Construction in June of that year. An earthfill wall, an un-gated concrete spillway structure and spillway apron on the left abutment, and intake tower and outlet works, and a 3.9 km long delivery pipeline to the Umtata purification plant comprise the main elements of the scheme. The wall is complete; crest length is 650 m and maximum height above foundation level in 35 m; side slopes are 1:3 upstream and 1:2.33 downstream. The spillway has an ogee-shaped profile, a crest length of approximately 160 m, a horseshoe shape, and is concrete-lined. The intake tower is 26 m high, rectangular in shape, and comprises a 3 x 6 m dry well and a control room. The tight schedule and flash floods at the site caused problems. The embankment had to be built during the rainy season and a separate large diversion system had to be devised. During a flood, the coffer dam was breached, the embankment excavation flooded and filled with silt, and a subcontractor lost all his plant and equipment. Despite these problems Grinaker is confident of meeting the October closure date. (Schaefer-IPA)
W79-08523

LONDON'S WATER SUPPLY IN THE 21ST CENTURY,
Thames Water Authority, London (England). Planning Directorate.
B. Protheroe, and J. Mitchell.
Water, No. 25, p 11-14, March 1979. 6 fig, 2 tab.

Descriptors: *Tunnel construction, *Water supply, Tunnel design, Engineering structures, Underground structures, Tunnels, Pipelines, Water conveyance, Water management(Applied), Rehabilitation, Construction costs, Cost analysis, Long-term planning, Planning, Thames Water Authority.

The careful look given by the Thames Water Authority at a major part of its water supply and distribution system, and the consideration given to a new tunnel ring main as an alternative to piecemeal replacement are examined. The preferred strategy for long-term planning of the London water supply system must offer economic advantage or must justify additional expense. A water ring main linking the major filtration works has been suggested; about 50 km of new large diameter tunnels in the clay will be needed. This layout would offer considerable operational flexibility, would avoid some of the cost and disruption of laying new or replacement trunk lines, and would cost less than maintaining the present system. An economic comparison is detailed showing costs and savings. The use of wedge block tunnels is ideally suited to London geology. These tunnels can be driven very quickly because the lining is precast and mechanical excavation is used; in 2.5 meter internal diameter tunnels, rates over 400 meters per week have been achieved. Large tunnel mains have not shown any serious problem concerning water quality. Precise alignment of tunnels is to be the subject of further study and site investigation; a construction timetable must take into account vulnerability of existing areas to failure. (Schaefer-IPA)
W79-08587

8B. Hydraulics

ENERGY DISSIPATION BY DAM CREST SPLITTERS,
P. R. Roberts.
The Civil Engineer in South Africa, Vol. 19, No. 11, p 263-264, November 1977. 4 fig, 1 tab, 5 ref.

Descriptors: *Dam design, *Arch dams, *Spillways, *Spillway crests, Peak discharge, Aeration, Air entrainment, Engineering structures, Model studies, Flow characteristics, Hendrick Verwoerd Dam, Orange River Project, South Africa.

Results of hydraulic model tests of the Hendrick Verwoerd dam crest splitters are presented. Hendrick Verwoerd Dam, in the Orange River Project, South Africa, has a maximum spillway head of 9.1 m and a spillway length of 233.4 m. The major conclusions from the tests include: (1) a splitter head design of 7.3 m performed satisfactorily up to 8.3 m when the splitter and the step were aerated for high heads; (2) splitters significantly reduced scour in the river bed; (3) splitters greatly reduced average pressures at the river bed level; and (4) flow stability improves and noise is reduced when splitters are aerated. Other work established that the angle between the spillway crest and the underside of the splitter was important to splitter performance. The spillway characteristics of 23 splitter-equipped South African dams are tabulated. (Davison-IPA)
W79-08503

DOLOS ARMOR UNITS USED ON RUBBLE-MOUND BREAKWATER TRUNKS SUBJECTED TO NONBREAKING WAVES WITH NO OVERTOPPING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. D. Carver, and D. D. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 434, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-77-19, November 1977. 85 p, 45 fig, 4 tab, 11 ref, 1 append.

Descriptors: *Breakwaters, *Hydraulic similitude, *Laboratory tests, *Waves(Water), Coastal structures, Model studies, Stability, Wave pile-up, Reynolds number, Coastal engineering, *Rubble-mound breakwaters, *Dolosse, Wave forces, Wave damage.

This report addressed the use of dolos armor on breakwater trunks subjected to nonbreaking waves and with no overtopping. The majority of the tests reported herein were designed to determine the stability coefficient, K, and runup and rundown values for the above conditions. Additional limited tests were conducted to show what effects (1) varying the first underlayer stone material from 1/5 to 1/20 of the armor weight would have on armor stability, wave runup, and wave rundown; (2) placing the dolosse in selected geometric patterns would have on stability; and (3) reducing the number of dolosse used in the cover layer would have on stability. Test results showed that (1) a stability coefficient, K = 31, is reasonable for nonbreaking waves on breakwater trunks; (2) varying the first underlayer stone material from 1/5 to 1/20 the armor weight does not significantly affect the stability or the wave runup and rundown values; (3) of the three geometric patterns considered, only one increased the stability above that of random placement; (4) reducing the number of dolosse in the cover layer does reduce the stability; (5) selective use of dolosse on a 1:1.5 slope may be feasible if the stability is assured by specific model tests; and (6) model tests of dolosse should be designed to eliminate the Reynolds scale effect in the first underlayer as well as the armor cover layer. (Adams-ISWS)
W79-08547

CHANNEL FLOW COMPUTATIONS USING CHARACTERISTICS,
Lanchester Polytechnic, Coventry (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-08556

STEADY FLOW PAST PRISM IN RECTANGULAR CONDUIT,
Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
C. C. K. Kwok, and P. M. Lee.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14697, p 845-857, July 1979. 9 fig, 3 tab, 3 ref, 2 append.

Descriptors: *Mathematical models, *Theoretical analysis, *Nozzles, *Orifice flow, Pressure, Drag, Numerical analysis, Model studies, Conduits, Computers, Equations, *Two-dimensional flow, *Streamline, Joukowsky transformation, Conformal transformation.

A general method for evaluating contraction and drag coefficients for a two-dimensional flow through a sharp-edged orifice or past a prism symmetrically located in a rectangular conduit was presented. The method was based upon the free-streamline analysis and used a sector hodograph to cover orifices with various nozzle angles and a Joukowsky transformation to transform a line integral in a complex plane into a definite integral. The same method was applied to predict the pressure distribution on the surface of the prism. Both the predictions and the computed coefficients were in general agreement with the previous findings and with the present experiments. (Bhowmik-ISWS)
W79-08557

COMPOUND WEIR DISCHARGE,
Science and Education Administration, Minneapolis, MN. St. Anthony Falls Hydraulics Lab.
F. W. Blaisdell, and C. L. Anderson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14688, p 817-826, July 1979. 8 fig, 1 ref, 2 append.

Descriptors: *Mathematical models, *Model studies, *Weirs, *Orifice flow, Discharge coefficient, Equations, Spillway crests, Channels, Banks, Spillways, *U-shaped weir, Rectangular and triangular weir.

A mathematical model for computing the discharge over a compound weir was developed by separating the weir shape into geometrical elements, computing the discharge through each element using well-known equations for weirs and orifices, and summing the individual discharges through each element. The method was checked and the discharge coefficients were evaluated by a physical model. The accuracy obtained was well within practical needs. The results obtained suggest that similar methods can be used for related practical applications. The weir modeled was U-shaped in plan. When linearized, the shape was a high level trapezoid superimposed on a low level trapezoid. To prevent overbank flow from dropping into the channel and eroding the channel banks near the spillway, the low weir was sized to have a capacity equal to that of the approach channel at bank-full discharge. (Bhowmik-ISWS)
W79-08558

ENLARGEMENT OF MARCUS HOOK ANCHORAGE, DELAWARE RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 2L.
W79-08610

SIMULATION OF TRANSIENT SUPERCRITICAL CHANNEL FLOW,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
J. J. Zovne, and C. S. Martin.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14708, p 859-875, July 1979. 10 fig, 4 tab, 22 ref, 2 append.

Descriptors: *Numerical analysis, *Open channel flow, *Supercritical flow, *Unsteady flow, *Hydraulic transients, Hydraulics, Stability, Mathematical models, Equations, Model studies, *Method of characteristics, Differential equations, Courant condition.

Two explicit numerical integration methods applied to the characteristics form of the St. Venant equations were investigated for the solution of

transient, supercritical, open-channel flow problems. The characteristics-grid method which has been widely used for transient subcritical problems was found to be unworkable in the supercritical regime. The rectangular-grid method was found to be more useful, but it becomes unstable for mesh spacings greater than 100 ft and for flows exceeding the stability Froude number. Integration methods developed for subcritical transient simulation are, therefore, not readily and universally adaptable to the supercritical regime. (Adams-ISWS)
W79-08615

A MODEL FOR CALCULATING STEADY-STATE FLOW IN A WATER NETWORK (MODELE DE CALCUL DE L'ECOULEMENT EN REGIME PERMANENT DANS UN RESEAU D'EAU MAILLE),
Societe de Traction et d'Electricite, Brussels (Belgium). Dept. of Research and Development.
T. Lekane.
Journal of Hydraulic Research, Vol. 17, No. 2, p 149-163, 1979. 3 fig, 19 ref. 1 append.

Descriptors: *Model studies, *Networks, *Water distribution(Applied), *Systems analysis, Pipelines, Mathematical models, Steady flow, Computer models, Analytical techniques, Foreign research, Distribution systems, Flow, Analysis, Flow rates, Hydraulic conduits, Water pressure, SWANN model, Water network.

Calculation of steady-state pressure and flow distributions in a water network is an important requirement for network operators and planners. The SWAN model described in this report is suitable for simulation of networks comprising pipes, non-return and pressure-reducing valves, pumps and storage tanks or reservoirs. Mathematical formulation of the model was based on description of its hydraulic elements by algebraic equations and nodal topological network analysis procedure. The non-linear model equations were solved by application of the NEWTON-RAPHSON method. Used in conjunction with sparse matrix triangularization and convergence acceleration procedures, this method can be used to calculate large networks while maintaining calculation times and the amount of data storage within reasonable limits. An application of the SWAN model to test and real networks was presented as an example. (Humphreys-ISWS)
W79-08749

8C. Hydraulic Machinery

RECOVERY OF ENERGY FROM THE WATER GOING DOWN MINE SHAFTS,
Chamber of Mines, Johannesburg (South Africa). Environmental Engineering Lab.
A. Whillier.
Journal of the South African Institute of Mining and Metallurgy, Vol. 77, No. 9, p 183-186, April 1977. 2 fig.

Descriptors: *Mine water, *Energy conversion, *Hydraulic turbines, Recirculated water, Industrial water, Water utilization, Entropy, Enthalpy, Thermal properties, Water management(Applied), Water reuse, Turbines.

An outline of the influence of energy-recovery systems for downgoing mine service water on the temperature rise of the water, and the cost benefits arising from the use of such systems are presented. The potential energy of the downgoing water is dissipated by friction into thermal energy. Some of the potential energy of the water could be recovered in a simple water turbine. Such an arrangement would halve the net pumping power demand to the surface-located refrigeration plant and would halve the increase in temperature of the water, giving a substantial increase in cooling available in the stopes. A Mollier diagram for water in which the energy content (enthalpy) is plotted against entropy is used to calculate frictional flow. Turbine efficiency is graphically plotted against the temperature rise of water, showing the fraction of total energy recovered. A cost benefit example illustrates that pressure-recovery systems are justifiable expenditures. (Schaefer-IPA)
W79-08517

THE USE OF CYLINDRO-CONICAL SETTLERS FOR THE CLARIFICATION OF UNDERGROUND WATER,
Harmony Gold Mining Co., Ltd. Welkom (South Africa).
E. C. Hunter, and G. T. C. Emere.
Journal of the South African Institute of Mining and Metallurgy, Vol. 77, No. 10, p 201-206, May 1977. 7 fig, 1 ref.

Descriptors: *Mine water, *Conical settlers, *Deposition(Sediments), Waste water treatment, Mining, Flow rates, Settling velocity, Sedimentation rates, Flocculation, Costs, Hydraulic equipment, Mud.

The performance of conical settlers at the Harmony Gold Mine from 1959 to the present is examined. The settlers, installed for the efficient settling of mud and grit, are now made from fiber glass instead of sheet metal, have an estimated indefinite working life, but cost twice as much to install as those originally in use. Raw water is treated with milk of lime, and the pH value is increased from 6.8 to about 8.5 to reduce corrosion and increase flocculation. The action within the settler is that of countercurrent settling. The use of flocculent became essential when the quantity of water handled increased; an experiment is detailed indicating the advantage of the use of flocculents. Flow rates for conical settlers of up to 9.5 Ml/d were achieved during tests, but settling at this rate was unsatisfactory. Flows in the region of 8 Ml/d were achieved with moderate results. Daily operating costs, based on 27 Ml settled per day, was R 4.15/Ml. Conical settlers can be placed close together because of their superior strength; they therefore occupy a small amount of space where space is at a premium because of gold values. Observation shows less side-wall and general deterioration than theoritized; this means less initial support cost and less subsequent support involvement. (Schaefer-IPA)
W79-08524

8D. Soil Mechanics

ANALYTICAL SOLUTIONS TO THE PROBLEMS OF TRANSIENT DRAINAGE THROUGH TRAPEZOIDAL EMBANKMENTS WITH DARCIAN AND NON-DARCIAN FLOW,
Center for Water Resources Development and Management, Trivandrum (India).
For primary bibliographic entry see Field 2F.
W79-08575

8E. Rock Mechanics and Geology

ENGINEERING GEOLOGY OF SMALL WATER STORAGE STRUCTURES IN AUSTRALIAN ARID REGIONS,
New South Wales Univ., Kensington (Australia).
F. C. Beavis, J. C. Beavis, and L. M. Reade.
The Quarterly Journal of Engineering Geology, Vol. 11, No. 4, p 279-290, 1978, 6 fig, 5 tab, 8 ref.

Descriptors: *Water storage, *Reservoir storage, *Dams, *Water tanks, *Reservoir design, *Reservoir construction, *Engineering geology, Reservoir evaporation, Reservoir leakage, Water loss, Hydrogeology, Geologic investigations, Australia.

In arid and semiarid regions where precipitation is low and evaporation high, it is important that small water storage structures be properly designed to minimize seepage losses, maximize storage, and maintain salinity at a minimum. In arid Australia where three types of storage are utilized for stock and domestic purposes: the excavated tank, the ring tank, and a combination of excavated tank and earth dam, it is particularly important that storage facilities be properly sited and designed to suit local materials. The investigation of one such tank-earth dam system located near Broken Hill, Australia, is described here to establish a basis for the location, design and construction of small water storages in arid regions. Although it was not possible to comment on the performance of the tank and dam due to only 30 mm of rain since completion and no runoff, the main geotechnical, chemical, hydrological and meteorological criteria required for assessment within a particular region are elucidated: the nature and depth of weathering, the nature and behavior of the soils and in particular stability, reaction to wetting and drying, and compaction characteristics. Soil chemistry is also significant since this will determine the chemical quality of the water and hence the uses to which it can be put. (Tickes-Arizona)
W79-08563

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

SAFE TO DRINK,
Public Health Lab. Service, Truro (England).
I. Barrow.
Water, No. 25, p 7-8, March 1979.

Descriptors: *Water quality control, *Potable water, *Public health, Domestic water, Water quality standards, England, Environmental sanitation, Human diseases, Publications, Reviews, Sanitary engineering, Water pollution.

The book 'Water supply hygiene -- safeguards in the operation and management of public water works in England and Wales' is reviewed and some of the background of its production is presented. The water industry of England and Wales reorganized in 1974 and water supply and sewage disposal were amalgamated. A new dimension with important implications for the safety of water supply appeared with the introduction of multi-functional operations due to the merger. Also, increased water usage and the consequent need for more recycling, with its attendant potential hazards of pollution, made the monitoring of safe supplies and sources important. The book is an up-to-date code of safety and good hygienic practice which started life in 1939 in response to a serious outbreak of typhoid fever at Croydon two years earlier. Screening of waterworks employees for diseases, improvements in water treatment and examination, and a better understanding of the epidemiology of waterborne infections have helped prevent the spread of disease. Practical precepts for the following are included: the integration of services; the protection of sources of supply, including public access and recreational facilities; works of repair and maintenance as well as for materials in contact with water; and the supervision of service reservoirs, mains, and valves. (Schaefer-IPA)
W79-08586

AN ANNOTATED BIBLIOGRAPHY ON WATER CONSERVATION,
Planning and Management Consultants Ltd., Carbondale, IL.
D. D. Baumann, K. Alley, J. Boland, P. Carver, and B. Kranzer.
Submitted to U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia. April 1979. IWR Contract Report 79-3 187 p. DACW72-78-M-0752.

Descriptors: *Water conservation, *Bibliographies, Publications, Documentation, Abstracts, Planning, Water policy, Water management(Applied), Water, Water distribution(Applied), Water demand.

Recent interest in the role of conservation in water supply planning has prompted an urgent need for information in the area of water conservation planning. The currently available literature on water conservation measures was surveyed. About 750 items were reviewed in both published and unpublished sources including government manuals, pamphlets, research reports, masters theses, doctoral dissertations, and conference proceedings

Items selected are representative of the major problems in the area. Each item is annotated with the bibliographic reference; a summary for each describes objectives, reports methodology, and summarizes and critically appraises the salient findings. Author index included. (Schaefer-IPA)
W79-08594

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 2.
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W79-08612

10D. Specialized Information Center Services

ADVANCES IN GROUNDWATER HYDROLOGY.
For primary bibliographic entry see Field 2F.
W79-08631

AN INTRODUCTION TO ADVANCES IN GROUNDWATER HYDROLOGY,
Illinois Univ. at Chicago Circle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W79-08632

PROGRESS IN RESEARCH ON WELL HYDRAULICS,
Rice Univ., Houston, TX. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W79-08634

A REVIEW OF THE INTEGRODIFFERENTIAL EQUATIONS APPROACH TO LEAKY AQUIFER MECHANICS,
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. of Applied Mathematics.
For primary bibliographic entry see Field 2F.
W79-08635

ADVANCES AND UNCERTAINTIES IN THE STUDY OF GROUNDWATER FLOW IN FISSURED ROCKS,
Rice Univ., Houston, TX. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W79-08636

STOCHASTIC ANALYSIS OF FLOW IN AQUIFERS,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 2F.
W79-08637

ADVANCES IN GROUNDWATER FLOW MODELING,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2F.
W79-08640

THE FINITE ELEMENT METHOD IN GROUNDWATER TRANSPORT,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-08642

DISPERSION IN NON-UNIFORM AND ANISOTROPIC POROUS MEDIA,
Shell Development Co., Houston, TX.
For primary bibliographic entry see Field 2F.
W79-08645

THEORETICAL DEVELOPMENTS AND PRACTICAL NEEDS IN THE FIELD OF SALT WATER INTRUSION,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-08649

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SELECTED WATER RESOURCES ABSTRACTS

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OCTOBER 1, 1979

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Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is attached to the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 19
OCTOBER 1, 1979

W79- 08831 -- W79-09080

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff, Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2D. Evaporation and Transpiration

RELEVANCE OF IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W79-08873

2E. Streamflow and Runoff

A MATHEMATICAL MODEL FOR UNSTEADY-FLOW COMPUTATIONS THROUGH THE COMPLETE SPECTRUM OF FLOWS ON THE LOWER OHIO RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
B. H. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 242, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. H-77-18. Final Report, October 1977. Prepared for U.S. Army Engineer Division, Ohio River, Cincinnati, Ohio. 47 p, 8 fig, 3 tab, 8 ref, 2 append.

Descriptors: *Mathematical models, *Ohio River, *Flow control, *Dams, *Flow rates, Navigable rivers, Levees, Flood control, Flood forecasting, Locks, River flow, Hydrographs, Model studies, Synthetic hydrology.

A model, Simulation of Open Channel Hydraulics in Multi-Junction Systems (SOCHMJ), was calibrated and modified to simulate flow conditions of the Ohio River. The model can be applied to condition of low-flow as well as flooding. The water system studied is composed of portions of six rivers, the Ohio, Green, Wabash, Cumberland, Tennessee, and Mississippi Rivers. The system also involves five locks and dams on the Ohio River. Modifications were made to allow for the specification of two time steps, one for branches with spatial steps about five miles in length and the other for smaller branches with spatial steps about a mile or less in length. Results showed that the model is potentially useful to assist in regulating navigation dams on the Ohio River. Also flood control simulation is possible to safeguard the Mississippi River levee system, reduce the frequency of use of the Birds Point-New Madrid floodway, and to reduce the frequency and magnitude of flooding of lands not protected by levees. (Seigler-IPA)
W79-09064

2F. Groundwater

AQUIFER MODELING BY NUMERICAL METHODS APPLIED TO AN ARIZONA GROUNDWATER BASIN,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6A.
W79-09052

2H. Lakes

ZOOBENTHOS OF LAKES,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
For primary bibliographic entry see Field 5C.
W79-08833

A MATHEMATICAL HYDRODYNAMIC CIRCULATION MODEL OF GREAT SALT LAKE FOR RESOURCE MANAGEMENT,
Utah Water Research Lab., Logan.
G. Z. Watters, and C. T. Kincaid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 013, Price codes: A05 in paper copy, A01 in microfiche. Final Report, June 1979. 74 p, 27 fig, 14 tab. OWRT B-139-UTAH(6), 14-34-0001-7191.

Descriptors: Finite element method, Hydrodynamics, Circulation, Salts, Stratified flow, *Model studies, Mathematical models, *Great Salt Lake, Utah.

A hydrodynamic circulation model for Great Salt Lake was developed along with several supporting mathematical models required to provide information on boundary conditions and mixing processes. Two of the supporting models were developed to describe bidirectional (1) seepage flow, and (2) culvert flow through the railroad causeway which divides the lake into a north and south arm. A third model utilizes the velocity field computed by the circulation model and provides information on convective and dispersive processes in the lake. A laboratory study was directed toward establishing the diffuse transfer of material from the lower layer of the south arm to the upper layer. The mathematical models were converted to numerical models using the finite element method. Solutions were found using the Galerkin method of weighted residuals. The seepage flow analysis was used to develop curves of northward and southward flow through the railroad causeway fill for various lake surface elevations. The bidirectional culvert flow analysis was not similarly successful, and the analysis of earlier investigators was taken as adequate. Attempts at modeling circulation within the two water layers in the south arm with a three-dimensional free surface model were successful to a degree, but solution of the equations proved too costly with existing computer facilities. A two-dimensional, depth-averaged circulation model was completed to compute velocity fields in the upper layer of the south arm. The convection-dispersion model utilized the resulting velocity field and computed dispersion and decay of salinity and pollutants. The present model does not handle wind-driven circulation, but it appears to work for flow-through boundary conditions.
W79-09054

PRELIMINARY WATER-QUALITY EVALUATION OF A LOWER POOL ELEVATION FOR PROPOSED LAFARGE LAKE, WISCONSIN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
D. E. Ford, K. W. Thornton, and D. L. Robey.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 822, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper No. Y-77-2. Final Report, May 1977. Prepared for U.S. Army Engineer District, St. Paul, Minnesota. 75 p, 33 fig, 5 ref.

Descriptors: *LaFarge Lake, *Water quality, *Mathematical models, *Eutrophication, *Computer models, *Elevation, Wisconsin, Phosphorus, Reservoirs, Algae, Diatoms, Dissolved oxygen, Turbidity, Coliforms, Vollenweider loading curves, Altitude, Nutrient requirements, Water temperature, Kickapoo River, Hypolimnion.

A modified version of the reservoir portion of the Water Quality for River-Reservoir Systems (WQRRS) ecological model was used to simulate the water quality of a proposed lake, LaFarge Lake, Wisconsin. The lake was previously modeled for a higher elevation of 256m., and results from this study are used for comparisons. This simulation was for a lower elevation of 250.5m. Areas studied were water temperature, dissolved oxygen content, and algal growth. Results show that at the lower elevation temperature stratification was weak and intermittent. The distribution of dissolved oxygen was good during periods of complete mixing, but was rapidly depleted on the lake bottom during periods of stratification. Two major blooms of blue-green algae were predicted during the summer and fall. During the spring, a bloom of green algae and diatoms was predicted. At the lower elevation of 250.5m, the magnitude of the blue-green algae bloom increased, and coliform persisted longer. Also at the lower elevation, the phosphorus loadings were approximately twice as large, but due to an increased flushing rate at that level, the eutrophication potentials were similiar at both elevations. (Seigler-IPA)
W79-09065

2J. Erosion and Sedimentation

PALEOLIMNOLOGIC EVIDENCE FOR INCREASED ZINC LOADING IN LAKES OF NEW ENGLAND, U.S.A.,
Maine Univ. at Orono. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5C.
W79-08909

CORRELATION BETWEEN EXCHANGEABLE PHOSPHORUS AND SEDIMENTARY PIGMENT IN SOME IRISH LAKES,
Dundalk Regional Technical College, County Louth (Ireland). Science Dept.
For primary bibliographic entry see Field 5C.
W79-08922

2L. Estuaries

NUTRIENT KINETICS OF PHYTOPLANKTON IN THE PAMLICO RIVER, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
E. J. Kuenzler, D. W. Stanley, and J. P. Koenings.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 063, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute of The University of North Carolina, Raleigh. UNC-WRRI Rpt. No. 139, May 1979. 163 p, 49 fig, 40 tab. OWRT B-092-NC(1), 14-34-0001-6105.

Descriptors: *Nutrients, *Phytoplankton, Nitrogen, Phosphorus, Sampling, *Pamlico River(NC).

A field study of physical conditions, nutrient concentrations, and phytoplankton abundance in the Pamlico River estuary was conducted in conjunction with laboratory measurements of rates of photosynthesis and uptake of nitrate, ammonium, and phosphate under ambient and experimental conditions. The estuary is shallow, turbid, and well-oxygenated, with salinities mostly in the range 2-15%. Dinoflagellates dominate the phytoplankton, especially during winter blooms of Heterocapsa triquetra. Filterable reactive phosphorus (mostly orthophosphate) concentrations were relatively high in the estuary, especially in the middle reaches during summer. Ammonium and nitrate concentrations, however, were relatively low; nitrate was only above 1 microgram-at N/l during winter periods of heavy freshwater inputs. Most of the particulate-P and particulate-N appeared to be phytoplankton. Phytoplankton productivity ranged from 1-4 microgram-at C/lh during most of the year, but exceeded 16 micrograms-at C/lh during winter blooms and in September 1976 when cell counts were relatively low. Phytoplankton seemed to account for most of P-uptake in the estuary, with rates being very high during algal blooms. (Kiger-North Carolina)
W79-09057

TRANSIENT ANALYSIS OF WATER QUALITY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
B. Davidson, R. Vichnevetsky, and R. Chella.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 187, Price codes: A02 in paper copy, A01 in microfiche. Final Technical Completion Report, Water Resources Research Institute, Rutgers University, April 6, 1979. 3 p. OWRT A-045-NJ(4), 14-34-0001-8032.

Descriptors: *Estuaries, *Dispersion, Model studies, Roughness coefficient.

The research project was designed to formulate an intra-tidal-time, deterministic, one-dimensional, non-isothermal, multistate-variable, water quality model for the Upper Delaware River estuary system. The results achieved include the develop-

ment of numerical techniques for estimating best-distributed Manning's roughness coefficients for open estuarial river systems. The publication giving these results is cited. (See W79-03115) (Whipple-New Jersey)
W79-09059

USER GUIDE FOR THE ENHANCED HYDRODYNAMICAL-NUMERICAL MODEL,
Compass Systems, Inc., San Diego, CA.
A. D. Stroud, and R. A. Bauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 464, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-074, July 1978. Prepared for the U.S. Environmental Protection Agency, Corvallis Environmental Research Laboratory, Oregon. 149 p, 6 fig, 12 tab, 9 ref, 6 append. 68-03-2225.

Descriptors: *User guides, *Mathematical models, *Hydrodynamics, *Tidal waters, *Synthetic hydrology, Thermal pollution, Monte Carlo methods, Tidal marshes, Coastal marshes, Advection, Currents(Water), Tidal flats, Upwelling, Heat budget, Boundaries(Surfaces), Linear programming.

Documentation needed for use of the Enhanced Hydrodynamical-Numerical (HN) Model for near-shore processes is presented. The model is a multilayer Hansen type with a non-linear extension, a layer disappearance extension, a thermal advection enhancement, and a Monte Carlo diffusion enhancement. The model consists of four separate programs, Phases I, II, III, and IV, all coded to run on a CDC 6000-7000 series computer. A single program library documented in the guide includes Phases I, II, and IV. Phase I produces the initial geographic data set. Phase II, the main computational routine, solves the hydrodynamic equation set which can include as options the non-linear convection term and the treatment of areas where a layer disappears. As an option it also advects a set of points using Monte Carlo techniques. Phase IV uses the HN velocity fields as input to the Pedersen-Prahm advection method and decays the heat content of the advected volume. The guide provides library structure, usage and maintenance, and notes on implementation of the model. Program notes, listings, sample runs, and module listings are included as appendices. (Seigler-IPA)
W79-09067

ENHANCED HYDRODYNAMICAL-NUMERICAL MODEL FOR NEAR-SHORE PROCESSES,
Compass Systems, Inc., San Diego, CA.
R. A. Bauer, and A. D. Stroud.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 887, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-073, July 1978. Prepared for the U.S. Environmental Protection Agency. Corvallis Environmental Research Laboratory, Oregon. 66 p, 29 fig, 6 tab, 23 ref, 1 append. 68-03-2225.

Descriptors: *Mathematical models, *Hydrodynamics, *Tidal waters, *Synthetic hydrology, Thermal pollution, Monte Carlo methods, Tidal marshes, Coastal marshes, Advection, Currents(Water), Tidal flats, Upwelling, Heat budget, Boundaries(Surfaces), Linear programming.

An optimized multilayer Hansen type Hydrodynamical-Numerical (HN) model is presented with extensions and enhancements to allow more accurate modeling of the dynamics of near-shore processes. This version of the HN model combines the vertically integrated single layer HN model and the multilayered multiple-open boundary HN model. Extensions and enhancements are: a non-linear term extension to improve small-mesh studies of coastal areas, a layer disappearance extension to enable correct procedures in marshy regions, a thermal advection enhancement to allow for thermal pollution consideration, and a Monte Carlo diffusion enhancement for dispersion procedures. Results of procedural model verification showed that a non-linear (convection) term should be incorporated whenever an HN application is expected to have significant current gradients. The layer disappearance extension and the thermal advection enhancement were both successful within the assumptions made. The Monte Carlo technique compared favorably to the conservative advection by method of moments in terms of quantitative results. Only procedural verification of the extensions and enhancements is provided. (Seigler-IPA)
W79-09068

THE DYNAMICS OF AN ESTUARY AS A NATURAL ECOSYSTEM, II,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
F. J. Vernberg, W. Kitchens, H. McKellar, K. Summers, and R. Bonnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 963, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-092, October 1978. Prepared for the U.S. Environmental Protection Agency, Environmental Research Laboratory, Gulf Breeze, Florida. 85 p, 13 fig, 7 tab, 57 ref, 1 append. R 804407-01.

Descriptors: *Estuarine environment, *Ecosystems, *Dynamics, Aquatic environment, Estuaries, South Carolina, North Inlet Estuary, Bioassay, Analytical techniques, Environmental effects, Simulation analysis, Grasses.

A study on the ecosystem dynamics of a relatively undisturbed estuary, the North Inlet Estuary, near Georgetown, South Carolina, is presented. Two separate but interrelated substudies are described: (1) a macroecosystem study to examine the dynamics of the ecosystem, and develop and update a model of an estuarine ecosystem which would predict probable effects of environmental perturbation; and (2) a microecosystem study to develop and test replicate experimental salt marsh units as diagnostic tools for the assessment of both long- and short-term pollution effects on the Spartina alterniflora salt marsh community. Results included an update and simulation studies of an energy flow model and a more detailed investigation of the applicability of a microecosystem for assessing environmental perturbation. Three recommendations were made: (1) study of relatively undisturbed ecosystems is necessary in order to understand the dynamics of how systems work and to serve as a vital baseline of comparisons; (2) granting agencies need to recognize the need for supporting such long-term projects; and (3) this phase of the study should be continued. (See also W78-11966) (Schaefer-IPA)
W79-09075

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF COMPOSITE HOLLOW FIBERS,
Bend Research, Inc., OR.
R. W. Baker, R. P. Barss, and H. K. Lonsdale.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 014, Price codes: A03 in paper copy, A01 in microfiche. Final report of Phase I, June 1979. 40 p, 19 fig, 7 tab, 10 ref. OWRT S-0017(no. 7552)(1), 14-34-0001-7552.

Descriptors: *Reverse osmosis, *Desalination, Hollow fibers, Fiber spinning, Composite membrane.

The objective of this program is to demonstrate the feasibility of using inside-skinned composite hollow fibers for brackish water desalination via reverse osmosis. Composite hollow fibers potted in modules with tube-side feed should be more resistant to fouling and less expensive than current module designs, partly because expensive pretreatment of the feed is unnecessary and partly because the fibers are self-supporting and do not require expensive pressure-containment vessels. The performance of these fibers compares favorably with current cellulose acetate brackish water membranes, and is superior to commercial brackish water hollow fiber systems. (Rykken-Bend)
W79-09053

3D. Conservation In Domestic and Municipal Use

MUNICIPAL WATER DEMAND MANAGEMENT,
Toronto Univ. (Ontario). Dept. of Geography.
A. P. Grima.
Water Spectrum, Vol. 11, No. 3, p 27-35, Summer 1979. 9 fig, 1 tab, 2 ref.

Descriptors: *Domestic water, *Municipal water, *Water conservation, Measurement, Water measurement, Water consumption(Except consumptive use), Water quality, Potable water, Water types, Pricing, Water rates, Elasticity of demand.

The uses, costs, alternatives, metering, pricing, and variables affecting municipal water are examined. Safe, potable water has become increasingly expensive even where water resources are relatively plentiful. Due to the increase in investment costs and other cost factors it is opportune to investigate whether these costs for the residential water supply could be reduced by conservation, and if so, how and by how much. Metering and the design of more rational water rates achieved substantial reduction in municipal water use in general and residential water use in particular. Supply, environmental and socio-economic conditions, and quality of service affect municipal water use. Education of consumers has resulted in conservation. Metering, accompanied by a suitable consumption charge, tends to reduce sprinkling use and other uses on the critical maximum day and peak hour; metering does not affect high priority in-house uses such as washing, cooking, and bathroom use. Expenditures on main transmission and local distribution are affected only marginally by reduction in water demand; development of sources and provision of pumping, purification and local storage facilities are affected directly. A more rational approach to water rates could reduce pressure on required investment for municipal water supply and sewage. Reductions in water use and effluent discharges would produce pressures on water quality in lakes and rivers. (Schaefer-IPA)
W79-09062

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RELEVANCE OF IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W79-08873

4D. Watershed Protection

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT. VOLUME 12. SEDIMENT TRANSPORT,
Hydrologic Engineering Center, Davis, CA.
W. A. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 600, Price codes: A10 in paper copy, A01 in microfiche. Report HEC-IHD-1200, June 1977. 211 p, 25 fig, 17 tab, 16 ref, 7 append.

Descriptors: *Sediment transport, *Methodology, *Analytical techniques, *Reservoirs. *Streams,

*Mathematical studies, Model studies, Sediments, Channel morphology, Rivers, Simulation analysis, Computer models, Soil erosion, Watersheds(Basins), Data collections, Aggradation, Degradation, International Hydrological Decade, Hydraulic engineering, Water resources development.

One volume of a 12-part series on hydrological engineering methods for water resources development prepared for the International Hydrological Decade deals with movement of sediment in flowing water, including processes of scour, transport, and deposition of inorganic material in free-flowing streams and in reservoirs. River morphology, data collection and analysis, reservoir sedimentation, and aggradation and degradation in streams are discussed. Practical approaches and techniques for analyzing sediment problems are emphasized. Information is provided on application of digital computer simulation to calculation of the volume and location of sediment deposits in reservoirs, and to predicting aggradation or degradation trends downstream from dams and in free-flowing streams. Some sediment transport formulas are included. Specific goals were to: (1) identify potential problem areas, (2) determine which can be analyzed with existing mathematical techniques and which one require movable-bed hydraulic models or the prototype, (3) determine type and quantity of data needed for problem-solving, and (4) provide a guide for solving sediment problems. Analysis of such problems may be approached in three steps: (1) calibrate the analytical technique, (2) verify the procedure with a base test for comparison with observed conditions, and (3) interpret effects of changes by reference to the base test rather than to absolute magnitudes. (Lynch-Wisconsin)
W79-08831

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

COMPARISONS OF MODELS PREDICTING AMBIENT LAKE PHOSPHORUS CONCENTRATIONS,
Environmental Monitoring and Support Lab., Las Vegas, NV.
S. C. Hern, V. W. Lambou, and L. R. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 637, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA-600/3-79-012, February 1979. 14 p, 3 tab, 10 ref.

Descriptors: *Trophic level, *Mathematical models, *Phosphorus, *Lakes, *Eutrophication, Water pollution, Water quality, Vollenweider model, Dillion model, Larsen/Mercier model, Rates, Oligotrophy, Mesotrophy, Mathematical studies.

The Vollenweider, Dillion, and Larsen/Mercier models are discussed, applied, and compared. Ambient lake phosphorus concentrations in 39 lakes calculated by applying each model are compared in a table to the known concentrations determined by the National Eutrophication Survey (NES). Spearman rank correlation coefficients were calculated for each trophic ratio against measured ambient phosphorus concentrations. Results are: Larsen/Mercier (0.94), Dillion (0.92), and Vollenweider (0.82). The Larsen/Mercier model and the Dillion model, both of which take into consideration the phosphorus retention capacity of lakes, provided the closest estimations. The Vollenweider model, which does not contain a phosphorus retention capacity element, produced the poorest estimate of ambient phosphorus concentration. Trophic states (eutrophic, mesotrophic, and oligotrophic) were calculated and compared to the NES trophic state assignments. Results show a 14, 18, and 25 percent disagreement, respectively, for the Dillion, Larsen/Mercier, and Vollenweider models. Values from two western reservoirs are used to illustrate factors that must be considered for using each model such as phosphorus retention capacities, information needed, flushing rate, mean lake depth, and the theoretical eutrophic 'loading' rate. (Seigler-IPA)
W79-09070

GROUNDWATER QUALITY MONITORING OF WESTERN COAL STRIP MINING: IDENTIFICATION AND PRIORITY RANKING OF POTENTIAL POLLUTION SOURCES.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 457, Price codes: A12 in paper copy, A01 in microfiche. Interagency Energy-Environment Research and Development Program Report No. EPA-600/7-79-024. January 1979. Everett, L. G., Ed. Prepared for the U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada. 26

Descriptors: *Strip mines, *Coal mine wastes, *Pollutant identification, *Groundwater-surface relationships, *Monitoring, Coal mines, Water pollution sources, Water quality control, Groundwater, Mining, Industrial wastes, Waste disposal, Analytical techniques, Water pollution, Waste water(Pollution).

The first phase of a project to design a system to monitor the impact of western coal strip mining on groundwater quality is presented. This phase includes the field survey and literature research to identify and rank the major sources of groundwater quality degradation. The study site follows the outcrop of the Fort Union Formation in Campbell County, Wyoming. Priority ranking, which will serve as the basis for the design of a monitoring plan, was based upon a sequence of data compilation and evaluation steps including: identification of potential pollution sources, methods of waste disposal, and potential pollutants associated with the various waste sources; and an assessment of the potential for infiltration and subsequent mobility of these pollutants in the subsurface. Pit discharge represents a potential source of groundwater pollution for active mining; the changing chemical environment caused by the relocation of spoils is a permanent potential source. Spoils placed below the water table should have top priority among mining sources because of the very polluting nature of the spoils placed there and the contact of those spoils with groundwater. Second priority should be given to rerouted surface water percolating into the spoils. For coal conversion activities, top priority should be given to fly ash landfill disposal below groundwater level; second priority should be the fly ash slurry pond. (Schaefer-IPA)
W79-09071

GROUNDWATER QUALITY MONITORING OF WESTERN OIL SHALE DEVELOPMENT: IDENTIFICATION AND PRIORITY RANKING OF POTENTIAL POLLUTION SOURCES.
Interagency Energy-Environmental Research and Development Program Report No. EPA-600/7-79-023, January 1979. Slawson, G. C., Jr., Ed. Prepared for the U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada. 238 p, 82 fig, 40 tab, 72 ref, 1 append. 68-03-2449.

Descriptors: *Oil shales, *Pollutant identification, *Monitoring, *Groundwater-surface relationships, *Water pollution sources, Water quality control, Groundwater, Mining, Industrial wastes, Waste disposal, Analytical techniques, Water pollution, Waste water(Pollution).

The first phase of a project to design a system to monitor the impact of western oil shale development on groundwater quality is presented. The phase included the field survey and literature research to identify and rank the major sources of groundwater quality degradation. The oil shale operation proposed for the eastern Utah test site includes room-and-pillar mining, surface retorting by the Paraho and TOSCO II process, and surface disposal of spent oil shale. Priority ranking which will serve as the basis for the monitoring plan, was based on a sequence of data compilation and evaluation steps including: identification of potential pollution sources, methods of waste disposal, and potential pollutants associated with the various waste sources; and an assessment of the potential for infiltration and subsequent mobility of these pollutants in the subsurface. Over two dozen potential sources of groundwater quality impact were identified; these include elements of extraction, retorting, upgrading, and waste disposal processes, as well as highly variable elements such as storm runoff. The highest priority potential pollutants associated with each area were identified; those for the spent shale area were spent shale, high total dissolved solids wastewater, sour water, retort water, and spent catalysts; spent shale was the highest source for retention dams; those for the process area were the proposed effluent holding pond, raw shale storage, and tankage area. (Schaefer-IPA)
W79-09072

A STUDY OF THE PHYSICO-CHEMICAL FORMS OF TRACE METALS IN NATURAL WATERS AND WASTEWATERS,
Caulfield Inst. of Tech., Victoria (Australia). Water Studies Center.
B. T. Hart, and S. H. Davies.
Australian Water Resources Council Technical Paper No. 35, 1978. 206 p, 18 fig, 42 tab, 207 ref, 2 append. Australian Government Publishing Service, Canberra. 74/60.

Descriptors: *Trace elements, *Physicochemical properties, Australia, Water chemistry, Properties, Physical properties, Chemical properties, Biological properties, Analytical methodologies, Aquatic environment, Cadmium, Iron, Copper, Lead, Zinc.

Research aimed at the development and application of analytical methodologies to provide useful information on the physico-chemical forms of selected trace metals in Australian waters is presented. Evidence indicated that the form of the metal can significantly influence the types of interactions occurring between trace metals and the various components of aquatic systems. These components include the biota, sediments, suspended particulates, and water. In order to have a complete understanding of the fate and biological activity of trace metals in aquatic systems, it is essential to have a knowledge of their speciation. A short review on the current state of knowledge on the speciation of cadmium, copper, lead, zinc, and iron, the main processes likely to influence the forms present, and the implications of the metal forms on their mobility and biological activity in natural waters is presented. Results of studies aimed at testing a number of potentially useful analytical methodologies for metal speciation are included; the results and discussion of investigations to test the applicability of those methodologies to a wide range of natural waters are reported. Recommendations are made on the use and development of techniques. (Schaefer-IPA)
W79-09080

5B. Sources Of Pollution

HELSINKI METROPOLITAN AREA WATER SUPPLY AND WATER QUALITY IN LAKE PAIJANNE,
Hydrobiological Research Inst., Jyvaskyla (Finland).
For primary bibliographic entry see Field 5C.
W79-08964

TRANSPORT OF OILY POLLUTANTS IN THE COASTAL WATERS OF LAKE MICHIGAN: AN APPLICATION OF RARE EARTH TRACERS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
D. L. McCown, K. D. Saunders, J. H. Allender, J. D. Ditmars, and W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL-WR78-1, Price codes: A06 in paper copy, A01 in microfiche. Report Nos. ANL/WR-78-1 and EPA-600/7-78-230, November 1978. EPA/DOE Interagency Agreement. Prepared for the U.S. Environmental

Protection Agency, Office of Energy, Minerals and Industry and the U.S. Department of Energy, Office of Health and Environme

Descriptors: *Tracers, *Path of pollutants, *Oily water, Rare earths, Dyseprosium, Samarium, Water pollution, Tagging, Tracking techniques, Analytical techniques, Lake Michigan, Chicago, Illinois, Indiana Harbor Canal, Water supply, Water treatment, Filtration, Coasts, Lakes.

Methods were developed for simultaneously tagging and tracing both oily wastes and the underlying waters and for determining their individual motions in fresh coastal waters. Indiana Harbor Canal (IHC) water and simulated oily-wastes on the surface of that water were simultaneously tagged. In a summer and a winter study the tagged cloud was tracked and sampled. Rare earth element (REE) tags (dyseprosium and samarium) were used; neutron activation analysis was used for tag detection and concentrations. Industry along the IHC draws water from Lake Michigan for it cooling process; water returned to the lake via the IHC is heated 5-8 C. In winter, the IHC effluent forms a plume of 4 C water and sinks near the IHC entrance; in summer, the canal effluent flows out on the surface and lake water intrudes into the canal along the bottom. Experiments were conducted for both floating- and sinking-plume conditions. Oily waste artificially mixed downward by a ship in the floating-plume study did not resurface; no differences were seen in the movement of the oily waste and underlying water; calculated diffusion coefficients for the REE tags were similar to values measured by others on the Great Lakes. The sinking-plume study showed unequivocal evidence of the transport of polluted IHC water to Chicago's South Water Filtration Plant; partitioning of oily wastes and water were indicated. Plume center-line dilution ratios for the entire IHC effluent plume were indicated to be as low as 2.8. (Schaefer-IPA)
W79-09074

5C. Effects Of Pollution

ZOOBENTHOS OF LAKES,

Copenhagen Univ. (Denmark). Freshwater Biological Lab.
P. M. Jonasson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 13-37. 19 fig, 2 tab, 64 ref.

Descriptors: *Benthic fauna, *Food habits, *Depth, *Lakes, *Lake Esrom(Denmark), *Energy, Ecosystems, Ecology, Food webs, Productivity, Organic matter, Trophic level, Eutrophication, Species diversity, Growth rates, Succession, Denmark, Habitats, Hydrobiology, Biological communities, Feeding rates, Invertebrates, Limnology.

Research concerning zoobenthos in eutrophic Lake Esrom, Denmark shows that distribution of organic matter in aa lake basin profoundly influences zoobenthic species diversity, type of feeding, growth, biomass accumulation, population dynamics, and production, as well as turnover rates (P/B) of materials. Food is usually the most important factor influencing distribution of closely related species in eutrophic lakes. In Lake Esrom net profundal production equals net zooplankton production, and in the littoral and sublittoral it is higher; if metabolism is included, a much greater share of total energy flow passes through the benthic community than through zooplankton. This phenomenon should prove true for most lakes. The amount of available organic matter determines the total quantity of zoobenthos in many lakes. Faster growth in the littoral often allows more generations per time unit; many species are bivoltine. Herbivores often have high production and turnover rates, almost reaching the high zooplankton turnover rates. The surface feeders, which have periodic access to fresh food of high energy, have much higher growth rates and shorter life cycle than subsurface feeders. (Lynch-Wisconsin)
W79-08833

GROWTH OF THE UNICELLULAR ALGA SELENASTRUM CAPRICORNUTUM AS A FUNCTION OF P. WITH SOME INFORMATION ALSO ON N,

E. Steemann Nielsen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 38-42. 2 fig, 15 ref.

Descriptors: *Phosphorus, *Limiting factors, *Plant growth, *Growth rates, *Selenastrum capricornutum, *Culture media, *Testing procedures, *Laboratory tests, Chlorophyta, Unicellular algae, Nutrients, Nitrogen, Nitrates, Ammonium, Phosphates, Algae, Cultures, Chemostats, Half-saturation constant.

Phosphorus concentration required for growth of the unicellular chlorophyte Selenastrum capricornutum was investigated, and it was found that the type of culture medium and methodology were greatly significant in investigating the growth rate. The medium ordinarily used, Osterlind B, was not suitable for phosphorus determinations because it contained iron as the citrate, and a considerable part of the phosphate was bound and therefore unavailable to the algae. This fact led to the erroneous conclusion in other studies that a high phosphorus concentration is needed for optimal growth, when in fact extremely low concentrations ordinarily are sufficient for growth of unicellular algae. In addition, even with chemostats (as opposed to batch cultures) excessively high algal concentrations must be avoided to prevent possible production of autoinhibitors. In S. capricornutum, growth stops at three billion cells/l. In the revised tests, a modified Osterlind B medium was used, with micronutrienrs and cobalt, which contained EDTA in place of citric acid. A special counting technique was employed involving centrifugation. The half-saturation constant was 0.007 micro-atom P/l, compared with 0.3 microg-atom P with ordinary Osterlind B medium. Experiments with nitrate showed a half-saturation constant of 0.05 microg-atom N, whereas in ammonium tests at a concentration of 0.02 microg-atom N growth rate was 75% of the optimum. (Lynch-Wisconsin)
W79-08834

AN IMPROVED OXYGEN METHOD FOR MEASURING PRIMARY PRODUCTION IN LAKES,

Bern Univ. (Switzerland). Zoologisches Inst.
P. A. Tschumi, D. Zbaren, and J. Zbaren.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 43-48. 2 fig, 2 tab, 14 ref.

Descriptors: *Lakes, *Primary productivity, *Winkler method, *Measurement, *Methodology, *Oxygen method, *Testing procedures, Lake Bienne(Switzerland), Switzerland, Eutrophication, Volumetric analysis, Phototitration, Light, Darkness, Negative respiration, Sampling.

Improvements are described which overcome earlier problems in measuring primary productivity in eutrophic Lake Bienne in northwestern Switzerland using the Winkler oxygen method. Problems were: (1) imprecise oxygen determinations, especially during winter full circulation and with conditions of low productivity; and (2) occurrence of 'negative respiration,' significantly higher content of the exposed dark bottles compared with initial levels. The Winkler technique used for the light and dark bottle method was made 5-10 times more accurate by detecting the titration end-point photometrically, and by strictly standardizing all manipulations preceeding and during titration. But improved precision is possible only if not overshadowed by other sources of error, two of which are discussed here: (1) release of oxygen upon illuminating dark-adapted lake water before adding the Winkler reagents, and (2) instability of the oxygen concentration of undersaturated or oversaturated water. The first problem can be eliminated by opening bottles and adding the reagents in complete darkness. The second problem can be reduced by placing a swimming disc which is slightly smaller than the inside diameter of the sampler (to allow for free movement) on the water column. The disc considerably reduces direct contact and gas exchange between water and air. Attention to the sample bottle filling order is also helpful. (Lynch-Wisconsin)
W79-08835

FACTORS AFFECTING REMOVAL OF INORGANIC 14C FROM WATER,

Wayne State Univ., Detroit, MI. Dept. of Biology.
R. A. Hough, and G. J. Filbin.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theore-tische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 49-53. 1 fig, 3 tab, 11 ref. NSFGB-40311.

Descriptors: *Carbon radioisotopes, *Acidification, *Sparging, *Primary productivity, *Testing procedures, *Measurement, Inorganic compounds, Organic compounds, Michigan, Lakes, Bogs, Dissolved organ carbon, Bicarbonates, Carbonates, Water chemistry, Chelation, Buffers, Carbon dioxide, Laboratory tests, Methodology, Volume, Nutrient removal, Tracers, Lake St. Clair(MI), Heart Lake(MI), Carbon.

Removal of inorganic carbon-14 from water by acidification and gas sparging has become a common method of quantifying carbon-14 organic compounds released during primary production; this study investigates possible overestimation of organic carbon-14 with use of the method. Evaluation of the rate of carbon-14 bicarbonate removal shows that at the sparging flow rate which was used inorganic media and lake water samples of low dissolved organic content apparently can be purged of inorganic carbon within 3-4 minutes with no residual contamination. However, data suggest that some kinds of organic compounds can retard removal of inorganic carbon, in this case most notably tris buffer and compounds in bog lake water, and support suggestions that sparging times of 10 minutes or more should be used. The inorganic-organic carbon interaction appears to be fully reversible, and is not influenced by long-term incubation prior to acidification, such as would be used in carbon-14 productivity measurements, and with reasonable sparging duration it is not likely to cause experimental error. In these tests, both a laboratory growth medium and filtered lake water samples were used, the latter taken from two Michigan lakes, Lake St. Clair and Heart Lake (a young Sphagnum bog lake). Inorganic carbon-14 was removed within one min from a four-ml volume of inorganic growth medium by acidification and nitrogen sparging, and within two min from a 20-ml volume. Organic buffer or chelator increased removal time. (Lynch-Wisconsin)
W79-08836

THE PH-CO2 RELATIONSHIP IN NATURAL WATERS,

State Univ. of New York Coll. at Fredonia.
K. G. Wood.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 54-58. 2 fig, 1 tab, 4 ref.

Descriptors: *Carbon dioxide, *Total carbon dioxide, *Hydrogen ion concentration, *Acidity, *Alkalinity, *Methodology, Lakes, Ponds, Acid precipitation, New York, Meadow Pond(NY), Kitten Pond(NY), Adirondack Park(NY), Acidic waters, Equations, Volumetric analysis, Respiration, Silicates, Borates, Equilibrium.

A new method used for computing the respiratory quotient in the hypolimnion of Lake Erie, based on total carbon dioxide, was described in 1972; this paper presents a corrected equation for total carbon dioxide (given by Stumm and Morgan 1970), and tests it under various conditions of alkalinity and with added silicate and borate. The

original equation lacked corrections in the alkalinity term. With the new method, a duplicate sample of water is equilibrated with air at standard temperature, the pH and alkalinity are measured, and total CO2 is computed. Total CO2 is similarly determined for the unaerated sample; the difference between the two is D-CO2. This new form of CO2 is similar to free CO2, but the point of reference is changed from pH 8.34 to the pH at air equilibrium. As waters of alkalinity greater than 560 micro-equiv/l (most freshwaters) will reach air equilibrium at pH 8 or above, the numerical difference between D-CO2 and free CO2 may be slight, but D-CO2 can be positive or negative and allows computation of the degree of air saturation of CO2. It is concluded that the corrected equation will be most useful when X components are small relative to alkalinity. Effects of X components can be identified by various methods. For many natural waters the D-CO2 can be calculated by the unmodified equation. Water samples from two ponds in Adirondack Park, New York, affected by aicd rain. Meadow Pond (total alkalinity 36.3 microequiv/l, SiO2 64 micromole/l) and Kitten Pond (123.5 microequiv/l and 54 micromole/l respectively). (Lynch-Wisconsin)
W79-08837

A PROCEDURE FOR IMPROVING ESTIMATES OF IN SITU PRIMARY PRODUCTION AT LOW IRRADIANCES WITH AN INCUBATOR TECHNIQUE,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
E. J. Fee.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 59-67. 2 fig, 5 tab, 22 ref.

Descriptors: *Primary productivity, *Algae, *Measurement, *Methodology, *Mathematical models, *Lakes, *Light intensity, Phytoplankton, Chrysophyta, Flagellates, Estimating, Testing procedures, Incubation, Experimental Lakes Area(Ontario-Canada), Ontario(Canada), Canada, Model studies, Solar radiation, Light penetration, Thermocline, Hypolimnion, Epilimnion, Depth, Turbidity, Eutrophication, Calibration, Photosynthesis.

The author's earlier (1973) numerical model for estimating primary productivity grossly overestimates hypolimnetic primary production, due to errors in the slopes of photosynthesis-vs-light curves which only become important at subsaturating irradiances. The error did not appear previously because all model verifications were carried out in epilimnetic waters at saturating irradiances. In situations where total production occurs mostly at subsaturating irradiance, (usually in the thermocline and hypolimnion but in more turbid lakes also in much of the epilimnion) incubator irradiances should be corrected at depths below the level of 10% light penetration to ensure greatest accuracy. Differences in spectral composition of the light between incubator and lake are the most likely source of the error. The best correction procedure is to tune incubator photosynthesis-vs-light curves with in-situ results. The error was discovered in studies of Lake 226 and 302 in the Experimental Lakes Area of Ontario, Canada, in which massive concentrations of chrysophyte algae were found in the thermocline and hypolimnion. The algae were flagellated net plankton and so apparently had minimal zooplankton grazing and sedimentation losses. While model primary production data gave doubling times of 3-10 days, the blooms appeared intuitively to be the result of a slow process of biomass accumulation with low mortality. To resolve the matter, in 1976 simultaneous in-situ and model measurements of primary production were made. (Lynch-Wisconsin)
W79-08838

NATURAL COMMUNITY BIOASSAYS: PREDICTIONS OF RESULTS BASED ON NUTRIENT PHYSIOLOGY AND COMPETITION,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
S. S. Kilham, and P. Kilham.
In: Proceedings: 20th Congress, International Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 68-74, 2 fig, 1 tab, 24 ref. NSF OCE76-10183.

Descriptors: *Bioassay, *Biological communities, *Phytoplankton, *Nutrients, *Competition, *Plant physiology, Forecasting, Algae, Chrysophyta, Diatoms, Asterionella formosa, Fragilaria crotonensis, Stephanodiscus minutus, Abundance, Dominant organisms, Equilibrium, Lake Michigan, Great Lakes, Lakes, Succession, Eutrophication, Food chains, Growth rates, Model studies, Mathematical models, Phosphates, Silicon, Phosphorus, Silicates.

Using data for Lake Michigan taken from Schelske, et. al. (1974) and Stoermer, et. al. (in preparation), an analysis was made of the importance of relative proportions of nutrients (rather than concentrations) in determining interactions of phytoplankton species. While nutrient concentrations and rate of supply determine total yield of cells, their proportions are important in determining which species increase and which decrease in relative abundance due to competition for nutrients. Resource competition theory provides the framework for formulating predictions of nutrient-addition effects, and laboratory nutrient growth experiments on individual species provide basic data. Bioassay experiments are performed ideally in semi-continuous or continuous culture, varying nutrients along a gradient. Competitive interactions of species are determined by the relative ability of each to use the nutrients. In the data utilized, shifts in dominant species of diatoms along a silicon/phosphorus gradient is discussed. Asterionella formosa was a successful competitor at high Si/P ratios, Fragilaria crotonensis became dominant at intermediate ratios, and Stephanodiscus minutus grew best at low ratios. These species are useful standards for comparisons with other diatom species. While interactions of green and blue-green algae along a nitrogen/phosphorus gradient could also be analyzed, only scanty physiological information was available. (Lynch-Wisconsin)
W79-08839

VALIDITY OF 32P KINETIC EXPERIMENTS IN ALGAE,
Weizmann Inst. of Science, Rehovoth (Israel). Isotope Dept.
M. Stiller, M. Edelstein, H. Volohonsky, and C. Serruya.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 75-81, 5 fig, 2 tab, 6 ref. EPA R803120-01-0.

Descriptors: *Kinetics, *Phosphorus, *Absorption, *Phytoplankton, *Ankistrodesmus nannoselenae, *Testing procedures, Algae, Equilibrium, Laboratory tests, Darkness, Light, Nutrients, Model studies, Mathematical models, Lakes, Organic matter, Phosphates, Tracers, Chlorophyta.

Axenic cultures of the chlorophyte Ankistrodesmus nannoselenae were grown in synthetic Lake Kinneret (Israel) water. This technique was used to avoid the problem of seston in determining phosphorus uptake by algae; it has been demonstrated that dead organic matter is responsible for the disappearance of a certain fraction of P-32 from the water. Low molecular weight phosphorus compounds are excreted back as anionic forms, which may combine with colloids and be released as PO4(-3) available for algal uptake. This study was carried out to determine whether in such a simple system the phosphorus exchange and phosphorus uptake experiments were reproducible and could be interpreted by Lean and Nalewajko's two-compartment model (1976). Conclusions: (1) in steady-state tests, reproducibility of the slope was better in both dark and light runs than that of the isotopic equilibrium ratio (IER); (2) under non-steady-state conditions the reproducibility of the uptake rate constant of PO4(-3) (K sub f) in runs with addition of 14.8 ppb P was poor; (3) in dark conditions the intracellular P-32 increased and the exchange rate, estimated by assuming steady-state conditions, decreased by 40%; and (4) while the P-32 technique offers simplicity, interpretation of kinetic experiments still lacks an inter-disciplinary insight. The two-compartment model includes dissolved PO4(-3) in water and intracellular P. These results may suggest the existence of more than one intracellular component. (Lynch-Wisconsin)
W79-08840

A LABORATORY EXPERIMENT TO EXAMINE THE EFFECTS OF NUTRIENT ENRICHMENT ON MACROPHYTE AND EPIPHYTE GROWTH,
University of East Anglia, Norwich (England). School of Environmental Sciences.
D. Eminson, and G. Phillips.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 82-87, 3 fig, 1 tab, 23 ref.

Descriptors: *Norfolk Broads(England), *Eutrophication, *Nutrients, *Competition, *Macrophytes, *Epiphytes, *Phytoplankton, Algae, Najas marina, Oedogonium, Filamentous algae, Laboratory tests, Lakes, Shallow lakes, Shading, Plant growth, Succession, Diatoms, Chrysophyta, Water pollution effects.

Declines in macrophyte growth and diversity which have often accompanied nutrient enrichment of lakes appear to be more a result of increased growth of epiphytic or filamentous algae than of phytoplankton shading, at least in shallow lakes. Laboratory experiments with the macrophyte Najas marina grown in tanks filled with water from Upton Broad, a shallow lake in the Norfold Broads, England, suggested the following succession mechanism: (1) Without large amounts of nitrogen and phosphorus in the water, rooted aquatic macrophytes may dominate a lake through the competitive advantage of using sediments as a nutrient source. (2) With somewhat more nutrient availability an algal flora develops on the macrophytes which receives a continuous fresh supply of nutrients as water moves past them; they thus obtain a competitive advantage over phytoplankton which acquire nutrient deficient water layers around them and move less than the epiphytes relative to the adjacent water. (3) Only when the nutrient concentration exceeds the demand of macrophytes and epiphytes do phytoplankton develop. Increased phytoplankton crops did not occur in the experimental tanks, apparently a result of competition by epiphytic and filamentous algae for nutrients. Enrichment resulted in decreased macrophyte growth and increased standing crop of diatom epiphytes. After day 14 diatoms on N. marina declined; by day 20 the filamentous alga Oedogonium surrounded the plants; and was itself covered by diatoms. The shift of diatoms to Oedogonium was probably due to shading by the latter, which may also have accounted for the decline of the macrophytes. (Lynch-Wisconsin)
W79-08841

PRIMARY PRODUCTIVITY IN THE SUBMERGED AQUATIC MACROPHYTE CERATOPHYLLUM DEMERSUM,
Hydrobiologisch Inst., Nieuwersluis (Netherlands).
E. P. H. Best, and J. T. Meulemans.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 88-93, 3 fig, 3 tab, 10 ref.

Descriptors: *Primary productivity, *Photosynthesis, *Ceratophyllum demersum, *Macrophytes, *Lake Vechten(Netherlands), *Carbon cycle, Carbon radioisotopes, Incubation, Seasonal, Growth stages, Plant growth, Bicarbonates, Carbon dioxide, Light, Darkness, Respiration, Tracers, Excretion, Hydrogen ion concentration, Absorption, Carbon cycling nutrients, Netherlands, Submerged plants, Dormancy.

Primary productivity, respiration, and excretion of the submerged aquatic macrophyte Ceratophyllum demersum were studied to determine the plant's

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role in the carbon cycle of Lake Vechten, Netherlands. Photosynthetic activities in the plant's two distinct seasonal physiological and morphological stages were measured: (1) the normal vegetative stage occurring in the summer and characterized by vigorous growth and a long axis with whorls of slender leaves, and (2) the dormant stage in winter when no growth occurs and plants have short internodes and thick, brittle leaves. Carbon fixation was much higher at pH 6 than at the lake's normal pH 7-8, indicating photosynthetic use of CO2 rather than bicarbonate. Release of carbon dioxide and organic carbon from labelled plants under various conditions was followed to determine the magnitude of dark and light respiration relative to carbon fixation. Most experiments were carried out with preconditioned tips of C. demersum from a winter culture, consisting of an apex and six whorls of leaves, the most active portions of the plants. The plants were thus harvested in a dormant state, and kept at low light intensity, low temperature, and short day length to lift dormancy. Photosynthesis was highest 2-4 hrs after transfer to experimental conditions, with carbon-14 fixation amounting to 0.002%/mg dry wt/hr (0.3-0.5 mg C/g/hr). Excretion of nongaseous organic compounds was very low, while excretion of carbon-14 carbon dioxide was high. A seasonal photosynthetic effect was detectable. (Lynch-Wisconsin)
W79-08842

BIOMASS AND PRIMARY PRODUCTION IN A PHRAGMITES COMMUNIS TRIN. SWAMP IN NORTH JUTLAND, DENMARK,
Aarhus Univ. (Denmark). Ecological Lab.
H. H. Schierup.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978, Part 1, p 94-99. 5 fig, 13 ref.

Descriptors: *Phragmites communis, *Swamps, *Primary productivity, *Vejlerne Nature Reserve(Denmark), *Biomass, *Wetlands, Denmark, Fjords, Plant growth, Shallow water, Macrophytes, Seasonal, Roots, Rhizomes, Shoots, Reclamation, Bogs.

Variations in the biomass of roots, rhizomes, and aerial portions of a Phragmites communis stand in the swampy Vejlerne Nature Reserve in North Jutland, Denmark, were measured March-October by means of direct harvesting. Roots and rhizomes were separated into live and dead fractions, but only the figures for live rhizomes, quantitatively the most important, were considered reliable. Aerial portions of the plant grew May-August, with maximum biomass 1160 g dry wt/sq m. Net aerial primary production was 1160 g dry wt/sq m/yr, based on the sum of biomass changes, losses by death, and losses by consumers. Rhizome biomass decreased 425 g dry wt/sq m during March-August, and increased 1025 g dry wt/sq m August-October, when aerial parts began to wither. Total annual net production was calculated at 1760 g dry wt/sq m/yr, based on net aerial primary production plus net annual rhizome biomass increase (1025-425 g dry wt/sq m). The Vejlerne reserve is a wetlands system of shallow fjords reclaimed from Lim Fjord in the late 19th Century. P. communis is the dominant emergent macrophyte, with Typha latifolia playing a minor role. Sampling was conducted on 10 occassions in the western part of Han Vejle, the smallest fjord. Above-ground biomass was harvested with a hedge clipper aided by a wooden frame, and below-ground biomass with a corer. (Lynch-Wisconsin)
W79-08843

A METHODOLOGY FOR THE STUDY OF THE TROPHIC INTERACTIONS IN ZOOPLANKTONIC COMMUNITIES,
European Atomic Energy Community, Ispra (Italy).
F. Argentesi, and R. de Bernardi.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 100-104. 2 fig, 3 tab, 9 ref.

Descriptors: *Zooplankton, *Biological communities, *Methodology, *Statistical models, *Predation, *Completion, *Population dynamics, *Time series analysis, *Lago Maggiore(Italy), Trophic level, Mathematical models, Model studies, Analytical techniques, Causality, Mortality, Fecundity, Density, Cladocera, Leptodora kindtii, Bythotrephes longimanus, Daphnia hyalina, Bosmina coregoni, Diaphanosoma brachyurum, Chydorus sphaericus, Italy, Equations.

A mathematical methodology developed earlier for evaluating dynamic parameters of natural single-species zooplankton populations (fecundity and mortality rates) is extended to zooplankton community structure and trophic interactions, starting from population time series (density, fecundity, and mortality). A causality equation is established; from this, a methodology for assessing relationships among time series is developed, representing population dynamics of the zooplankton community. The system considered is a cladoceran community composed of two predators, Leptodora kindtii and Bythotrephes longimanus, and the filter-feeders Daphnia hyalina, Bosmina coregoni, Diaphanosoma brachyurum and Chydorus sphaericus. Only competitive and prey-predator interactions are weighed. For each proposed compartment the following time series data are available: population density in individuals/cu m, fecundity unit rate in eggs/day X female, and mortality unit rate in individual/day X individual. Because not all species were simultaneously present in the study area (Lago Maggiore, Italy), only a limited portion of the total structure could be investigated: interrelationships of Leptodora, Diaphanosoma, and Daphnia young and adults. Six possible relationships were distinguished for causality assessment for which time variables are presented. (Lynch-Wisconsin)
W79-08844

ECOSYSTEM MODELS VS BIOLOGICAL REALITY: EXPERIENCES IN THE SYSTEMS ANALYSIS OF AN ARCTIC POND,
Woods Hole Marine Biological Inst., MA.
J. E. Hobbie, and J. L. Tiwari.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 105-109. 2 fig, 11 ref.

Descriptors: *Computer models, *Ponds, *Arctic, *Ecosystems, *Analytical techniques, *Systems analysis, Model studies, Deterministic models, Stochastic processes, Alaska, Barrow(AK), Simulation analysis, Forecasting, Benthic flora, Algae, Phytoplankton, Zooplankton, Primary productivity, Biomass, Photosynthesis, Seasonal, Light, Water temperature, Sediments, Carbon cycle, Respiration, Excretion, Evaluation.

Evaluation of the usefulness of computer models developed for arctic ponds, based on research near Barrow, Alaska 1970-74, concludes: (1) available mathematical and computer techniques are adequate for modelling aquatic systems; (2) there is serious misunderstanding of how aquatic ecosystems operate; (3) these gaps prevent the models from being predictive at present; (4) the models are nonetheless useful for identifying research needs; and (5) stochastic models which incorporate natural variability will probably be a realistic way of modelling such ecosystems. The overall model could successfully simulate the seasonal biomass cycle and productivity rates. A stochastic model developed was quite stable, and small changes in sensitive coefficients did not cause such problems as occurred with the deterministic model. Modelling was useful: (1) as an aid to coordination of the project, (2) for requiring concise statements of knowledge and assumptions, and (3) as a means of following carbon flows and testing hypotheses. Negative aspects included: (1) inclusion of processes which could not be measured, (2) the fact that slight tuning adjustments caused great changes in results, (3) certain coefficients were over-sensitive, and (4) the model was not predictive. (Lynch-Wisconsin)
W79-08845

EMPIRICAL PHYSIOLOGICAL MODELS OF ECOSYSTEM PROCESSES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. H. Peters.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 110-118. 5 fig, 1 tab, 29 ref.

Descriptors: *Physiology, *Empirical data, *Aquatic animals, *Body size, *Forecasting, *Mathematical models, *Biomass, *Growth rate, *Biological communities, Model studies, Equations, Ingestion, Egestion, Weight, Detritus, Homeothermy, Poikilothermy, Productivity, Ecosystems, Size, Lakes, Succession, Food habits, Mortality, Feeding rates, Tracers, Simulation analysis, Analytical techniques, Methodology.

Body weight was successfully used to predict such holistic ecosystem properties as successional change and material flow, by means of equations taken from the literature which empirically describe physiological rates as a function of animal body weight. Graphs were constructed in which each point is an empirically determined value for one species representing growth rate and ingestion rate as a function of body weight. The slopes of all curves were taken as 0.75, a well-established 'metabolic scaling factor'. Such collations provide a basis for comparing data for the whole animal kingdom. The curves show an organism's trophic position has little influence on ingestion or production rate, and suggest (probably correctly) that poikilothermy has little effect on production, and (probably incorrectly) that homeothermy has little effect on ingestion. The physiological equations are used to describe a model ecosystem. Five size classes of animals (0.1, 1, 10,100, and 1000 g) were assigned an initial biomass of one g each and a detrital pool of 95 g. The physiology of each size class was defined by empirical relation for respiration, ingestion, growth, and egestion (excretion). The model then linked the size classes through a series of assumed trophic interactions: functional response, size-specific mortality, food-size selection, and random stress. All gave the same qualitative results, namely that succession leads to increased community biomass, larger mean body size, and a more equitable distribution of biomass. (Lynch-Wisconsin)
W79-08846

MODELLING THE EFFECTS OF INFLOW AND ORGANIC SEDIMENT ON NUTRIENT-PLANKTON DISTRIBUTIONS IN LARGE RESERVOIRS,
Washington State Univ., Pullmann.
R. A. Parker.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 119-122. 2 fig, 3 tab, 6 ref.

Descriptors: *Nutrients, *Reservoirs, *Advection, *Sediments, *Diffusion, *Phytoplankton, *Zooplankton, *Mathematical models, *Sediment-water interfaces, Model studies, Mixing, Spatial distribution, Inflow, Organic matter, Detritus, Eddy diffusion, Equations, Equilibrium.

Steady-state solutions are given for a system of nutrient-plankton equations which incorporate mass flow, diffusion, and exchange with sediments having inorganic and organic sources of an essential nutrient, such as phosphorus or nitrogen. In large well-mixed reservoirs showing little thermal stratification, nevertheless spatial heterogeneity of nutrient concentrations and plankton densities often is seen partly dependent on the extent to which dissolved-nutrient-containing compounds are added to or released from sediments. Concurrent action of advection and eddy diffusion has not previously been explored in detail in a model. A ten-fold increase in velocity produces a similar increase in the distance between population peaks. Higher nutrient content also increases period length, but only by about one-third. By contrast, raising organic concentration in the sediment pro-

duces a slight decrease in period, but the concentration in the water rises dramatically with small increases in dissolved inorganic nutrients and zooplankton. Sampling programs designed for large reservoirs could be improved if some sampling stations were located to take advantage of advective effects and if results from fixed sampling locations were compared with those from stations moving with the current. (Lynch-Wisconsin)
W79-08847

MODEL OF FUNCTIONING OF BIOLOGICAL SYSTEM,
Nicolas Copernicus Univ. of Torum (Poland). Inst. of Biology.
R. Bohr.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 123-126. 1 fig, 6 ref.

Descriptors: *Mathematical models, *Information theory, *Systems analysis, *Biological communities, *Analytical techniques, *Oxidation-reduction potential, Methodology, Biology, Model studies, Energy flow, Inorganic compounds, Organic matter, Eutrophication, Phytocenoses, Agrocenoses, Ecology, Ecosystems, Energy.

A model which simulates functioning of any biological system is founded on systems theory and information theory. The model illustrates a selected fragment and moment of ergomatter composed into a biological system, and is based on assumptions of the stability of earthly matter mass and of the cyclic progress in the structure of matter, presented in the form of a scalar drawing comprising an area between two concentric circles. Energy flow direction and intensity are shown by arrows, and the duration and succession of the system's consecutive stages are indicated by clockwise movement of the radius. Inorganic matter is marked with horizontal stripes and organic with vertical stripes; their density reflects the degree of mineralization of the inorganic part, or the organizing level of the organic part. The starting point is matter which has been built into the system by means of energy from outside--i.e., maximally reduced in the chemical sense. This is connected with the establishment of a great difference in the redox potential between the organic and inorganic matter, which necessitates energy transformations in two directions: progressing degradation through loss of energy and lowering of the degree of matter organization, and the contrary process of raising the energetic and structural level of matter by means of the work done from releasing free energy in the first process. The two basic properties of material structure, order and organization, must be considered. (Lynch-Wisconsin)
W79-08848

LIMNOLOGY IN THE HIGH ARCTIC: A CASE STUDY OF CHAR LAKE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
F. H. Rigler.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 127-140. 7 fig, 1 tab, 30 ref.

Descriptors: *Arctic, *Limnology, *Char Lake(Northwest Territories-Canada), *Lakes, *Oligotrophy, Primary productivity, Biomass, Phytoplankton, Zooplankton, Benthic fauna, Benthic flora, Cold regions, Energy flow, Carbon cycle, Eutrophication, Canada, Northwest Territories(Canada), Meretta Lake(Northwest Territories-Canada), Ice cover, Water temperature, Photoperiodism, Nutrients, Limiting factors, Light, Species diversity.

Ultraoligotrophic Char Lake (Northwest Territories, Canada), the only polar lake to have been comprehensively studied, is used to illustrate arctic limnology. Such lakes represent both extreme conditions and a simplified system. Whereas low nutrient loading appears to limit phytoplankton biomass, low temperature controls productions rate, and in consequence the production-to-biomass ratio (0.05-0.07) is lower than in temperate lakes. The benthic community is relatively more important in the arctic than in temperate regions; it is responsible for most primary production and respiration, and has the greatest diversity of species. Obtaining accurate population statistics of benthic organisms in arctic lakes remains a problem. In general there is little sign of adaptation; species merely develop and respire more slowly than at higher temperatures, and therefore respond slowly to environmental change. Long-term studies are thus needed to predict the response of arctic lake systems to increased nutrient loading or basin disturbances, both of which are known to affect the lakes. Char Lake has a mean summer chlorophyll-a level of 0.4 mg/cu m and an average annual phytoplankton primary production of 4.1 g C/sq m/yr. It is by far the most oligotrophic lake ever studied in detail. The nitrogen/phosphorus ratio is 23, and phosphorus loading is only 25 mg/sq m/yr due to low terrestrial export (2.3 mg/sq m/yr) and low precipitation. (Lynch-Wisconsin)
W79-08849

EFFECTS OF ICE COVER ON THE SOLAR RADIATION REGIME IN CANADIAN LAKES,
Department of Fisheries and Environmental, Ottawa (Ontario). Inland Waters Directorate.
W. A. Adams.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 141-149. 8 fig, 1 tab, 21 ref.

Descriptors: *Lakes, *Canada, *Ice cover, *Albedo, *Light penetration, *Solar radiation, *Optical properties, *Oil pollution, *Water pollution effects, *Arctic, Snow cover, Remote sensing, Primary productivity, Oil spills, Attenuation, Cold regions, Measurement, Instrumentation, Research equipment.

Measurement systems for characterizing optical properties of floating ice are described, some results of their use in several Canadian lakes in determining effects on light penetration are presented, and three areas of application are discussed: primary productivity, oil pollution, and remote sensing. The intensity and spectral distribution of solar radiation penetrating an ice-covered lake depends on optical properties (reflectance, scattering, and absorption) of the ice sheet and water column. Geographic location determines radiation quantity through solar elevation and seasonal hours of daylight; climate partially determines stratigraphy and duration of the ice cover. Field studies were carried out in the Mackenzie River delta, Balaena Bay (Northwest Territories) where crude oil was released under sea ice, Lake St. George (Ontario), and near Inuvik, Resolute, and Tuktoyaktuk. Two submersible irradiance meters were used, a diffuse irradiance measurement system and one based on an underwater quanta spectrometer. Calculation of the albedos and percent of solar radiation transmitted through ice showed the albedo to be greatly reduced by a thin film of crude oil. Wet snow or ice had a lower albedo than dry, but the wavelength dependence on moisture content was less clear. A reduction in transmitted light (about 40% greater mean attenuation after oiling) was correlated with primary productivity at 2.5 and 5.0 m below spring sea ice. (Lynch-Wisconsin)
W79-08850

SPATIAL VARIATION IN SIZE AND REPRODUCTIVE CYCLE OF LIMNOCALANOUS MACRURUS IN A DEEP SUBARCTIC LAKE, GREAT SLAVE LAKE,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
J. Patalas, and K. Patalas.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 150-158. 12 fig, 1 tab, 7 ref.

Descriptors: *Great Slave Lake(Northwest Territories), *Limnocalanus macrurus, *Zooplankton, *Depth, *Spatial distribution, *Reproduction, Cold regions, Water temperature, Water chemistry, Trophic level, Lakes, Canada, Northwest Territories(Canada), Reproduction, Crustaceans, Lake morphometry, Copepods.

Lake morphometry was the most significant factor controlling spatial distribution of the copepod Limnocalanus macrurus in Great Slave Lake, Northwest Territories, Canada. Sampling was conducted July-October 1968 and August 1972. L. macrurus' contribution to the total crustacean community ranged from 1.3% in the North Arm to 62.1% in Christie Bay. Lake depth correlated significantly with density of L. macrurus in the upper 50 m with greatest densities found in deeper stations (Christie Bay 1.7 ind/l and Hearne Channel 0.7 ind/l); with size of mature females (the largest females were found in the shallower part of the lake and the smallest in deep Christie Bay, 614 m); and with mean developmental stages; populations further advanced in development were found in shallower parts of the lake. The smallest animals were found in Christie Bay, larger animals in McLeod Bay, and the largest in the Western Basin. Water temperature did not sufficiently explain L. macrurus distribution. Previous observations show that L. macrurus females extrude eggs directly into the water; they sink to the bottom, and nauplii ascend to the upper trophogenic layers. Due to the depth of Christie Bay nauplii should not appear in the upper zone until long after the end of the reproductive period. In fact, young nauplii were found in the upper 50 m simultaneously with the most intensive reproductive activity, suggesting either that nauplii hatched directly without sinking, or they hatched from eggs produced the year before. (Lynch-Wisconsin)
W79-08851

ZOOBENTHOS OF LAKES LOCATED WITHIN AND OUTSIDE THE ILIMAUSSAQ INTRUSION IN SOUTH GREENLAND,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
C. Lindegaard, P. Maehl, and B. H. Nielsen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 159-164. 1 fig, 3 tab, 7 ref.

Descriptors: *Benthic fauna, *Ilimaussaq intrusion(Greenland), *Limnology, *Lakes, *Chironomidae, *Geology, *Species composition, Greenland, Ponds, Water chemistry, Bedrock, Baseline studies, Nutrients, Oligotrophy, Pisidium, Oligochaeta, Insects, Diptera, Midges, Altitude, Physicochemical properties, Physical properties, Faunal lists.

Seventeen ponds and lakes in the vicinity of the Ilimaussaq intrusion of South Greenland were investigated in 1975, partly to determine if fauna and flora in the lakes are influenced by unusual chemical features of the area. The intrusion is formed of nepheline syenites with high local concentrations of rare elements, including uranium, thorium, niobium, zirconium, beryllium, and lanthanides. This paper reports on benthic fauna, with a summary of physical and chemical results. Lakes were grouped in three regions, with Regions 1 and 2 within the intrusion, and Region 3 adjacent. Altitudes varied 3-135 m outside the intrusion, and 80-607 m within. The entire area was quite uniform in terms of water chemistry, and lakes were characterized as oligotrophic. Sixteen faunal species were identified (30% of known species in the lakes); Chironomidae dominated with 13 species and comprised 85-100% of total individuals. Oligochaeta and Pisidium sp were found only in small numbers. Faunal density ranged 2700-16,500/sq m in Region 1, 1750-2600/sq m in Region 2, and 0.-4400/sq m in Region 3. All but two of the lakes in Regions 1 and 2 were littoral lakes (transparency > depth), while all but one in Region 3 were profundal (transparency < depth). Differences in density between Regions 1 and 2 may be due to variation density, dependent on bedrock coarseness. Faunal differences can to some extent be ascribed to lake nutrient status and altitude. (Lynch-Wisconsin)
W79-08852

EFFECT OF VOLCANIC ASH DEPOSITS ON SOCKEYE SALMON LAKES,
Washington Univ., Seattle. Coll. of Fisheries.
O. A. Mathisen, and P. H. Poe.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 165-172. 5 fig, 3 tab, 12 ref.

Descriptors: *Sockeye salmon, *Iliamna Lake(AK), *Mount Augustine(AK), *Volcanoes, *Volcanic ash, *Food chains, *Fry, *Spawning, Juvenile fish, Oncorhynchus nerka, Alaska, Kvichak watershed(AK), Lakes, Oligotrophy, Fish, Zooplankton, Cyclops scutifer, Bosmina coregoni, Phytoplankton, Algae, Melosira, Nutrients, Phosphorus, Reproduction, Fish food organisms, Productivity, Limiting factors, Fertilization.

Eruption of the Mount St. Augustine volcano (Cook Inlet, Alaska) in January-February 1976 and deposition of volcanic ash over the Kvichak watershed, including Iliamna Lake, provided an opportunity to study effects of enrichment from the ash on the food chain which includes fry of sockeye salmon (Oncorhynchus nerka). These salmon spawn in many of the major oligotrophic lakes adjoining the North Pacific Ocean. Their food consists of such small zooplankters as Cyclops scutifer and Bosmina coregoni. Zooplankton production is limited by the lakes' normally low dissolved nutrient contents, in turn limiting salmon production. A previous study showed that volcanic eruption caused an immediate increase in diatoms, followed three years later by an eight-fold increase of Cyclops scutifer over the next three years. The Mount St. Augustine 1976 eruptions deposited 6.6-14.9 million metric tons of ash over about 13,000 sq km of the Kvichak watershed, with density in the eastern end ranging 1.1-2.1 kg/sq m. Ash composition included high silica content (63.3% by wt), absence of nitrogen, and higher total phosphorus content (654 ppm) than from carcasses of parent salmon, though only .09 ppm was water-soluble orthophosphate. There was an almost immediate increase of phytoplankton in Iliamna Lake, especially Melosira, but as yet (1976) no change has occurred in total secondary production, or in size or abundance of juvenile sockeye salmon. (Lynch-Wisconsin)
W79-08853

INTERNAL WAVES IN A FJORD LAKE,
Canada Centre for Inland Waters, Burlington (Ontario).
P. F. Hamblin.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 173-181. 7 fig, 1 tab, 5 ref.

Descriptors: *Fjord lakes, *Kamloops Lake(British Columbia-Canada), *Waves(Water), *Water temperature, *Mathematical models, *Internal waves, Lakes, Fjords, British Columbia(Canada), Canada, Thermal stratification, Mixing, Seiches, Isotherms, Model studies, Kelvin waves, Seasonal, Periodicity, Dynamic models.

Simple dynamic models are presented of internal waves observed 1974-75 in Kamloops Lake, an elongated and deep fjord lake in the interior Plateau of British Columbia, Canada, and model results are compared with field observations. Vertical displacements of monitored isotherms can be classified as: (1) motions of amplitudes of 10 m and periods of one hour or less, and (2) waves with amplitudes of 10 m and periods of 40-100 hrs. Well-defined separation between the two is illustrated both by time histories of isotherm displacements and by statistical summaries. A theoretical model for the long-period motions, known as internal Kelvin waves, may account for observed seasonal periodicity trends, despite simplifying assumptions, and the model appears to give accurate estimates for observed periodicities and for relative amplitudes at three lake locations. A model of the radiation of high-frequency internal waves from a uniform region in a stratified fluid accounts for several observed properties of high-frequency internal waves from a uniform region in a stratified fluid accounts for several observed properties of high-frequency waves having a localized source, either near the inflow or in regions of high shear associated with motions induced by the internal Kelvin waves. These processes are extremely important to the formation of lake thermal structure. High-frequency waves and associated mixing may account for relatively uniform temperature gradients in this type of lake, rather than a two-layer stratification. (Lynch-Wisconsin)
W79-08854

LAKES OF CENTRAL ALBERTA WITH EMPHASIS UPON MOOSE LAKE,
Alberta Univ., Edmonton. Dept. of Zoology.
D. N. Gallup.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 182-189. 6 fig, 2 tab, 13 ref.

Descriptors: *Alberta(Canada), *Moose Lake(Alberta-Canada), *Lakes, *Limnology, *Trophic level, *Eutrophication, Canada, Phytoplankton, Algae, Primary productivity, Light penetration, Nutrients, Chlorophyll, Standing crops, Water chemistry, Saline lakes, Morphometry, Depth, Dissolved solids, Water management, Cooking Lake(Alberta-Canada), Cold Lake(Alberta-Canada), Miquelon Lake(Alberta-Canada), Sylvan Lake(Alberta-Canada), Pigeon Lake(Alberta-Canada), Gull Lake(Alberta-Canada), Buffalo Lake(Alberta-Canada).

Eight prairie-parkland lakes near Edmonton, Alberta, Canada were studied 1973-74 to compare water chemistry and primary production to assist lake management efforts and to assess the trophic status of Moose Lake by comparison with the other lakes. Recent massive cyanophyte blooms indicate deteriorating water quality in Moose Lake. Lakes were grouped as saline (Gull, Cooking, Buffalo, and Miquelon Lakes) or freshwater (Moose, Cold, Pigeon, and Sylvan Lakes). Trophic status was best determined by light penetration, standing crop (chlorophyll-a), and primary productivity; the lakes ranged from oligotrophic (Cold Lake) to highly eutrophic (Cooking Lake). Miquelon Lake was the only lake for which nutrient conditions gave better results than the other three parameters, because its high salinity apparently affected phytoplankton growth. Nutrient levels showed it highly eutrophic. Chlorophyll-a values in Moose Lake (2-116 mg/cu m) were well within the eutrophic range, while daily productivity estimates of 0-3150 mg C/sq m/day indicated borderline mesotrophic-eutrophic conditions. In terms of total nitrogen/total phosphate, Moose Lake occupied a low-intermediate position. By chemical water quality, the lakes were (from good to poor): Cold, Pigeon, Sylvan, Moose, Gull, Buffalo, Miquelon, and Cooking. Mean depth (morphometry) and total dissolved solids were rejected as diagnostic parameters since neither showed much relationship to algal productivity. (Lynch-Wisconsin)
W79-08855

MEROMIXIS IN WALDSEA LAKE, SASKATCHEWAN,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
U. T. Hammer, R. C. Haynes, J. R. Lawrence, and M. C. Swift.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 192-200. 3 fig, 16 ref.

Descriptors: *Waldsea Lake(Saskatchewan-Canada), *Meromixis, *Saline lakes, *Water temperature, *Stratification, Saskatchewan(Canada), Lakes, Conductivity, Ice cover, Thermal stratification, Cold regions, Monimolimnion, Chemocline, Mixolimnion, Mesothermy, Shallow water, Winds, Depth, Anaerobic conditions, Salinity, Mixing.

Waldsea Lake, one of two known meomictic lakes in Saskartchewan, Canada, was first reported in 1971; this paper reports on its thermal and salinity regime based on 1970-77 studies. Meromictic lakes are those uncommon lakes which do not mix completely during one year. The lowest layer, usually more saline and anoxic than the other two, is the monolimnion, separated from the upper, fully circulating mixolimnion by the intermediate chemocline. Dichothermy, mesothermy, and poikilothermy are abnormal thermal stratifications common to meromictic lakes. Waldsea Lake is unlikely to maintain meromixis, since compared to other such lakes, it is large (4.64 sq km surface area), shallow (maximum depth 14.3 m, mean depth 8.1 m), unprotected from winds, and its ratio of monimolimnion salinity to mixolimnion salinity is relatively low, ranging from 1.88 in 1971 to 2.65 in 1972 (August). Waldsea Lake is therefore chemically less stable than most other meromictic lakes, such as Soap Lake (Washington) with a ratio of nine. Waldsea Lake is fed by four minor temporary streams, but has not outlet. Mesothermy (middle-layer maximum temperature) is characteristic of the lake from after mid-August until the ice cover is established. The lake tends to follow the temperature sequence of a typical temperature dimictic lake, but only in the mixolimnion. The variable location of the three layers over the course of the study period is discussed. (Lynch-Wisconsin)
W79-08856

CONTRIBUTION OF PHOTOSYNTHETIC GREEN SULPHUR BACTERIA TO TOTAL PRIMARY PRODUCTION IN A MEROMICTIC SALINE LAKE,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
J. R. Lawrence, R. C. Haynes, and U. T. Hammer.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 201-207. 4 fig, 20 ref.

Descriptors: *Meromixis, *Waldsea Lake(Saskatchewan-Canada), *Photosynthetic bacteria, *Primary productivity, *Saline lakes, *Stratification, *Photosynthesis, Sulfur bacteria, Bacteria, Saskatchewan(Canada), Canada, Lakes, Limnology, Carbon radioisotopes, Hydrography, Mixolimnion, Salinity, Chlorobium, Carbon fixation, Light penetration, Chlorobacteriaceae, Seasonal, Anaerobic conditions, Food webs.

Annual production of green sulfur bacteria (Chlorobacteriaceae) in saline, meromictic Waldsea Lake (Saskatchewan, Canada) is 46% of total primary productivity in the lake, based on studies in 1976-77. Maximum productivity of the bacteria is 1320 mg C/cu m/day (398 mg C/sq m/day), and annual production is estimated at 32 g C/sq m/yr. Phytoplankton productivity is 345 mg C/sq m/day, and annual production estimated at 38 g C/sq m/yr. Bacterial production is higher than previously thought, and may constitute an important base of food webs in some lake systems. In meromictic Waldsea Lake, total ion content of the monimolimnion (the lowest of the three strata) is 2.25 times greater than in the upper mixolimnion. The intervening chemocline thus exhibits steep physical and chemical gradients. The bacterial plate, dominated by Chlorobium, is located in a narrow 30-cm stratum at the interface of the chemocline and monimolimnion. No more than 5% of incident radiation, corrected for reflection, reaches the plate, and only 1% typically reaches the center of the plate where a massive population of Chlorobacteriaceae persists throughout the year. Growth conditions for these bacteria combine anaerobia, low electrode potential, medium to high pH, H2S, and light. Chlorobium principally contains BChl-d and accessory pigments, up to 2325 microg/l. Photosynthetic activity is intense in mid-summer with an unexplained depression in mid-July, but subsequently there is little net productivity despite high BChl-d levels. (Lynch-Wisconsin)
W79-08857

COLLAPSES OF APHANIZOMENON FLOS-AQUAE BLOOMS RESULTING IN MASSIVE FISH KILLS IN EUTROPHIC LAKES: EFFECT OF WEATHER,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.

J. Barica.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 208-213. 4 fig, 7 ref.

Descriptors: *Fishkill, *Aphanizomenon flos-aquae, *Eutrophication, *Collapse, *Oxygen depletion, *Light intensity, *Weather, *Manitoba(Canada), Air temperature, Water temperature, Cloud cover, Nutrient loading, Canada, Pothole lakes, Summerkill, Dissolved oxygen, Algae, Phytoplankton, Cyanophyta, Lakes, Chlorophyll, Biomass, Microcystis, Anabaena, Winds, Runoff, Solar radiation, Prairie Lakes.

Twenty-six partial or total algal collapses (1971-76) in three shallow, eutrophic, summerkill prairie lakes in the Erickson-Elphinstone area of southwestern Manitoba, Canada, were triggered by a sudden drop in light intensity resulting from overcast conditions. A concomitant (but sometimes delayed) drop in water temperature associated with the collapses was probably due to the overcast conditions as well. Fish mortality was caused only by blooms of Aphanizomenon flos-aquae; mixed blooms of Microcystis, Anabaena, and Aphanizomenon did not develop sufficiently extreme biomass levels. Probability and severity of summerkill depends on magnitude and duration of oxygen depletion, dependent in turn on maximum algal biomass. The three lakes (Lakes 885, 154, and 882) substantiated 100 microg/l chlorophyll-a as the dividing line between low and high summerkill risk, with exception of a 1975 bloom in Lake 885 which collapsed after reaching 80 microg/l. Biomass fluctuations are apparently controlled by nutrient loading, and therefore hydrologic and weather conditions during winter and spring runoff may strongly affect biomass levels. In advanced stages of bloom development an acute phosphorus deficiency occurs, resulting in yellowing and clumping of algae, and turbidity. Warm, sunny weather can maintain a bloom even under such nutrient-deficient conditions, but a sudden drop in light intensity or water temperature (or both) causes the bloom to collapse. (Lynch-Wisconsin)
W79-08858

REHABILITATION OF EUTROPHIC PRAIRIE LAKES IN CANADA,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
R. J. Allan, and B. C. Kenney.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 214-224. 4 fig, 3 tab, 27 ref.

Descriptors: *Lake restoration, *Qu'Appelle Basin(Canada), *Eutrophication, *Model studies, *Phosphorus, *Nutrient loading, *Runoff, Trophic level, Vollenweider models, Canada, Prairie lakes, Fishing Lakes(Canada), Pasqua Lake(Canada), Echo Lake(Canada), Mission Lake(Canada), Katepwa Lake(Canada), Lakes, Flushing rate, Chlorophyll, Hydraulic residence time, Spring, Ice cover, Forecasting, Algae, Phytoplankton, Primary productivity, Baseline studies, Tertiary treatment.

Data was compiled to document the status of the eutrophic Fishing Lakes (Pasqua, Echo, Mission, and Katepwa) in the Qu'Appelle Basin of south-central Canada prior to initiation in 1977 of tertiary sewage treatment in the town of Regina, which with Moose Jaw contributes some 50% of phosphorus inputs to the basin. A data collection program begun in 1976-77 will monitor improvements expected in the lakes. Calculation of annual phosphorus loading confirmed the lakes are an extreme case, with levels far exceeding many other lakes reported in the literature. Loadings with highest (up to 25 g/sq m) in years of medium and high spring runoff, compared with 3.3 g/sq m in low-runoff years. Application of recent models show trophic level is lowest in years of high spring runoff, and artificial spring flushing could help reduce phosphorus loading and further lower trophic level. Spring runoff also flushes phosphorus regenerated under winter ice. In drought years late winter total phosphorus concentrations up to 600 mg/cu m extend into spring, while in flood years levels are drastically reduced. Chlorophyll-a concentrations are very high in low-flow years and much lower in high-runoff years; concentrations are accurately predicted by Vollenweider's loading parameter, implying that reduction in phosphorus loading will result in reduced productivity. However, prediction of chlorophyll-a levels from phosphorus data overestimate measured values, possibly related to the very low spring total nitrogen/total phosphorus ratios in low-runoff years. (Lynch-Wisconsin)
W79-08859

PRODUCTION OF CLADOCERA INHABITING THE VEGETATED LITTORAL OF PINEHURST LAKE, ONTARIO, CANADA,
Malaya Univ., Kuala Lumpur (Malaysia). Dept. of Zoology.
R. P. Lim, and C. H. Fernando.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 225-231. 2 fig, 4 tab, 23 ref.

Descriptors: *Cladocera, *Littoral, *Limnetic zone, *Pinehurst Lake(Ontario-Canada), *Productivity, *Zooplankton, Ceriodaphnia quadrangula, Bosmina longirostris, Echinisca rosea, Acroperus harpae, Alonella exigua, Chydorus sphaericus, Ontario(Canada), Canada, Lakes, Growth rates, Growth stages, Water temperature.

In 1974-75 in small, shallow Pinehurst Lake (Ontario, Canada), overall cladoceran production in the vegetated littoral exceeded production in the limnetic zone; this is attributed to the greater diversity of habitats in the littoral, able to support a greater diversity and hence greater density of cladocerans. The six dominant species belong to six different genera: Ceriodaphnia quadrangula, Bosmina longirostris, Echinisca rosea, Acroperus harpae, Alonella exiguna, and Chydorus sphaericus. Both floristic and faunistic complexity can be considered responsible for the higher productivity of the littoral. Eurytopic species (Ceriodaphnia, Bosmina, and Chydorus) had higher daily production rates than species restricted to the littoral, though Chydorus' production rate in the limnetic zone was low and it was not dominant there. Daily production rates of Ceriodaphnia and Bosmina did not differ significantly between littoral and limnetic zone, except for Bosmina in 1975 when its littoral production was twice that of its limnetic production. Higher overall littoral production was due primarily to the combined contribution of the six dominant species, plus that of the other 32 species of the littoral. Within the littoral, Ceriodaphnia had the highest production in 1974 (16.61 mg dry wt/10 liters), and Bosmina the highest in 1975 (62.62 mg dry wt/10 liters). Total production for the six dominant littoral species was 67.31 mg/10 liters in 1974 and 139.20 mg/10 liters in 1975, and for the three present in the limnetic zone it was 27.71 mg in 1974 and 63.78 mg in 1975. (Lynch-Wisconsin)
W79-08860

NOTES ON ZOOPLANKTON FROM SOME LABRADOR LAKES,
Memorial Univ. of Newfoundland, St. Johns's. Dept. of Biology.
C. C. Davis.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 233-239. 2 fig, 3 tab, 14 ref.

Descriptors: *Labrador(Canada), *Smallwood Reservoir(Newfoundland-Canada), *Ten Mile Lake(Newfoundland-Canada), *Species composition, *Abundance, *Kaipokok-Makkovik-Big River region(Newfoundland-Canada), *Zooplankton, Lakes, Ponds, Reservoirs, Copepods, Cladocera, Newfoundland(Canada), Dominant organisms, Daphnia longiremis, Daphnia pulex, Bosmina coregoni, Holopedium gibberum, Cyclops scutifer, Diaptomus minutus, Daphnia galeata mendotae.

Zooplankton were surveyed in two areas of Labrador (Newfoundland, Canada): (1) 5700-sq km Smallwood Reservoir and adjacent Ten Mile Lake, sampled June-August 1974; and (2) the Kaipokok Bay-Makkovik Bay-Big River region (18 lake, pond, and stream sites sampled August 1975). Recent formation of the reservoir flooded extensive areas of uncleared forest and bog, and joined together several lakes and ponds. Results for Smallwood Reservoir indicate increased abundance of five of the seven most important crustaceans, compared to a 1975 report (Bosmina coregoni, Daphnia longiremis, D. pulex, Holopedium gibberum, and Cyclops scutifer); exceptions were Diaptomus minutus. Daphnia galeata mendotae, and in the Lobstick section D. pulex. Total quantity of zooplankton in the southern Michikamau section greatly increased, with an overwhelming shift in dominance from copepods to cladocerans; the earlier report gave a three-year maximum of only 483/cu m for D. longiremis, compared with 11,021/cu m in this study, while D. pulex increased 0-1159/cu m and B. coregoni from 782/cu m to 2321/ccu m. In the Daipokok-Makkovic-Big River area copepods generally dominated. The only diaptomid was the ubiquitous northern species Diaptomus minutus. Adult cyclopoids were notably subordinate, and rotifers were far less important than in Smallwood Reservoirs or Ten Mile Lake. D. longiremis was the only Daphnia species encountered, except for D. dubia in a single locality. (Lynch-Wisconsin)
W79-08861

DISTRIBUTION OF BENTHIC MACROINVERTEBRATE COMMUNITIES IN LAKE ERIE'S EASTERN BASIN,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
R. W. Flint, and C. N. Merckel.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 240-251. 7 fig, 1 tab, 12 ref.

Descriptors: *Lake Erie, *Invertebrates, *Benthic fauna, *Biological communities, *Habitats, *Distribution, *Eastern basin(Lake Erie), *Great Lakes, Lakes, Water pollution effects, Eutrophication, Sediments, Bioindicators, Faunal lists, Tubificids, Amphipoda, Sphaeriidae, Ecology, Ecosystems, Peloscolex, Sphaerium corneum, Aulodrilus, Stylodrilus heringianus, Mononchus, Potamothrix moldaviensis, Bithinia tentaculata, Limnodrilus hoffmeisteri, Pontoporeia affinis, Tubifex tubifex, Density.

Changes in the benthic environment of the comparatively oligotrophic eastern basin of Lake Erie are described in terms of the type of macroinvertebrate community and its structural changes during 1973-76. Chemical and physical gradients in bottom sediments and habitat determined community distribution. Since community variations were a function of geographical location rather than season, the 11 community types identified remained relatively stable over the four years of the study. Although symptoms of eutrophication have begun to appear in the basin, no anoxia occurred during the study period, and oxygen conditions probably were not a major distributional influence. Communities are identified by a characterizing species: (1) Peloscolex ferox, (2) Sphaerium corneum, (3) Peloscolex multisetosus, (4) Aulodrilus pleureseta, (5) Aulodrilus americanus, (6) Potamothrix modlaviensis, (7) Stylodrilus heringianus, (8) Mononchus sp, (9) Bithinia tentaculata, (10) Limnodrilus hoffmeisteri-Pontoporeia affinis, and (11) Tubifex tubifex. For each community a list of additional characterizing fauna is given. The eastern, shallow-water Aulodrilus pleuriseta community was considered transitional between the eastern, shallow-water Peloscolex community and the central, deeper Limnodrilus-Pontoporeia community, based on the composition of associated fauna. Sediment carbon content, soil texture, and sediment disturbances affected community type. (Lynch-Wisconsin)

W79-08862

PRODUCTION OF ZOOPLANKTON AT NEARSHORE STATIONS IN LAKES ONTARIO AND ERIE,
Ohio State Univ., Columbus. Dept. of Zoology.
D. A. Culver, and W. R. DeMott.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 252-256. 2 fig, 16 ref. U.S. Department of Interior, OWRT A048-Ohio.

Descriptors: *Zooplankton, *Productivity, *Nearshore zone, *Lake Ontario, *Lake Erie, *Biomass, *Water temperature, *Estimating equations, Bay of Quinte(Lake Ontario), Great Lakes, Lakes, Abundance, Size, Equations, Cladocera, Growth stages, Instars, Length, Seasonal, Summer, Methodology, Hydraulic residence time, Flushing rate, Computer programs.

A computer program was used to calculate nearshore zooplankton production estimates for one station (four m depth) in Lake Ontario's Bay of Quinte, and from 10 closely spaced stations (2.3-4.9 m depth) in Lake Erie's western basin. Lake Ontario samples were collected weekly during summer 1974, and Lake Erie samples monthly April 1975-March 1976. Vertical temperatures were assumed homogeneous at any one time and station. Productivity was calculated from: (1) abundance, (2) biomass, and (3) temperature-dependent developmental rates. The productivity equation is provided. Values were necessary for each instar or size class for each species. Bay of Quinte zooplankton biomass was strongly correlated with temperature; maximum weight coincided with high temperatures during clear, calm weather. With mean residence time of 0.07 years, flushing of the bay by river water was important. Unlike the mid-summer depression of numbers observed in many systems, biomass oscillated between the high and low values throughout the summer. In western Lake Erie both biomass and production exceeded that of the Bay of Quinte. A midsummer decline occurred, but the subsequent numerical increase in September-October was not reflected in a corresponding increase in productivity. Average productivity/biomass (P/B) ratios were comparable for the two sites (about 0.182 for Lake Ontario and 0.2 for Lake Erie), implying complete biomass turnover every five days in summer. Average P/B ratio was a poor estimate of the daily ratio, however, due to great variations. (Lynch-Wisconsin)
W79-08863

PHOTOSYNTHESIS, EXTRACELLULAR RELEASE AND GLYCOLLIC ACID UPTAKE BY PLANKTON: FRACTIONATION STUDIES,
Scarborough Coll., Toronto. Div. of Life Science.
K. Lee, and C. Nalewajko.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 257-262. 4 fig, 1 tab, 26 ref.

Descriptors: *Glycollic acid, *Phytoplankton, *Photosynthesis, *Size, *Lake Erie, *Lake Ontario, *Great Lakes, Primary productivity, Fractionation, Absorption, Bacteria, Diatoms, Chrysophyta, Chlorophyta, Cyanophyta, Lakes, Rhodomonas, Uroglenopsis americana, Scenedesmus bijuga, Tracers, Carbon fixation, Organic matter, Algae, Carbon radioisotopes.

Specific organisms responsible for primary production, extracellular release, and glycollic acid uptake based on size fractionation were studied with samples from Lakes Ontario and Erie (western basin) in summer 1976. Rhodomonas sp. was responsible for the highest photosynthetic rates. Extracellular release rates were highest in the phytoflagellates Rhodomonas sp. and Ureglenopsis americana, and in the chlorophyte Scenedesmus bijuga. Glycollic acid uptake was correlated with bacteria. Absolute amounts of soluble organic material released by photosynthetic algae in the two lakes was relatively small (less than 5%). Glycollic acid concentrations were 58 microg/l in Lake Erie and 24 microg/l in Lake Ontario. Several studies have indicated that up to 50% of total carbon fixed in the photic zone may be liberated into the water in soluble organic form; extracellular products could be significant as metabolites and energy sources for microorganisms. Filters of various pore sizes were used to fractionate natural populations prior to tracer additions. Photosynthesis, extracellular release, and carbon-14/glycollic acid uptake were linear in the tests. In Lake Ontario 79% of photosynthesis and 80% of algal biomass were in the size ranges 3-8 and above 70 micrometers (combined), dominated by the diatoms Asterionella formosa, Synedra ulna, and Stephanodiscus sp. In Lake Erie 89% of photosynthesis and 61% of biomass were in the 3-8 and 8-30 micrometer classes, dominated by the cyanophyta Aphanizomenon flos-aquae and Ababaena affinis. (Lynch-Wisconsin)
W79-08864

PHOSPHORUS REMOVAL AT GRAVENHURST BAY, ONTARIO: AN 8 YEAR STUDY ON WATER QUALITY CHANGES,
Ontario Ministry of the Environment, Rexdale.
P. J. Dillon, K. H. Nicholls, and G. W. Robinson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 263-271. 6 fig, 4 tab, 28 ref.

Descriptors: *Phosphorus, *Nutrient removal, *Sewage treatment, *Gravenhurst Bay(Ontario-Canada), *Eutrophication, *Phytoplankton, *Lake restoration, *Lake Muskoka(Ontario-Canada), Mathematical models, Nutrients, Nutrient budgets, Algae, Cyanophyta, Aphanizomenon, Ababaena, Microcystis, Biomass, Chlorophyll, Oxygen depletion, Water pollution control, Ontario(Canada), Canada, Species composition, Nitrogen, Model studies, Forecasting, Bays.

Phosphorus removal begun in 1971 for sewage effluents discharged into Gravenhurst Bay, an isolated portion of Lake Muskoka in southern Ontario, Canada, resulted in rapid improvement of water quality, which prior to 1972 had been characterized by severe algal blooms, poor clarity, and virtual absence of hypolimnetic oxygen. Phosphorus was reduced 55% from an average 44 mg/cu m 1969-71 to 20 mg/cu m in 1975, a level near that predicted by a nutrient budget model. Average chlorophyll-a concentration and algal biomass were halved (chlorophyll-a from an average of 9.8 mg/cu m to 5.0, and biomass from an average 2340 ASU/ml to 1120). There was a drastic reduction in the bloom-forming cyanophytes Aphanizomenon, Anabaena, and Microcystis from 33% of total biomass prior to removal to 15% by 1975. In late 1975 a second treatment plant began operation to accomodate the increasing population of the town of Gravenhurst, with half the municipal sewage output diverted through the new plant. However, chemical phosphorus removal with iron chloride proved inefficient (only 40% removal vs 90% at the old plant), and water quality deteriorated quickly, with an Aphanizomenon bloom climaxing at 43,000 ASU/ml. Correction of the technical difficulties resulted in reversal of the deterioration within three months, and conditions of low algal biomass and a species composition typical of oligotrophic Precambrian Shield lakes returned. (Lynch-Wisconsin)
W79-08865

AN INTRODUCTION TO THE INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,
Atmospheric Environment Service, Downsview (Ontario).
T. L. Richards.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 272-275.

Descriptors: *International Field Year for the Great Lakes(IFYGL), *Great Lakes, *Lake Ontario, *International cooperation, *Planning. *Basic data collections, *Water management(Applied), United States, Canada, International commissions, Lakes, Water conservation, Natural resources, Resource management, Water quality control, International Hydrological Decade, United Nations, UNESCO, Research facilities, Scientific personnel, History.

An overview of the planning and operation of the 1972-73 International Field Year for the Great Lakes (IFYGL) also introduces a symposium on IFYGL presented at the 1977 Congress of the International Association of Theoretical and Applied Limnology. Intensive data collection was undertaken April 1972-March 1973, with some projects extended to July 1973. Lake Ontario was selected as the study lake. All verified data are now in the Canadian and U.S. IFYGL data banks, final catalogues have been published or are in press, interim project status reports and more than 250 scientific papers have been published, and a detailed final overview is planned. The program originated about 1965 with growing awareness that a concentrated international and interdisciplinary study was necessary to ensure preservation of the lakes, recognized as an important natural resource to both countries. Sponsorship of IFYGL by UNESCO's International Hydrological Decade was proposed in 1965, and a steering committee was organized. A workshop was held in 1967, the IFYGL concept was endorsed by 70 scientists, and a formal policy statement was issued in April. Four scientific advisory working groups were set up to identify the most critical problems and later to asses the technical suitability of proposed projects; they also prepared a list of new facilities required. Funding was provided by several public and private agencies and groups in the two countries, particularly NOAA in the U.S. Over 150 projects were undetaken. (Lynch-Wisconsin)
W79-08866

HYDROLOGY OF LAKE ONTARIO,
Environmental Management Service, Cornwall (Ontario).
D. F. Witherspoon.
In: Proceedings: 20th Congress, International Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 276-279. 3 tab.

Descriptors: *Internationale Field Year for the Great Lakes(IFYGL), *Lake Ontario, *Hydrology, *Water balance, *Evaporation, *Great Lakes, Lakes, Equations, Estimating equations, Water management(Applied), Water level fluctuations, Inflow, Outflow, Precipitation(Atmospheric), Runoff, Groundwater, United States, Canada, International commissions.

Lake Ontario water balance was investigated as part of the International Field Year for the Great Lakes (IFYGL). Water balance results are needed for estimating evaporation. A water balance equation summarizes the hydrology of the lake, incorporating inflow from Lake Erie (I), outflow via the St. Lawrence River (O), water surface precipitation (P), runoff into the lake (R sub L), groundwater flow from the shores of the lake (G sub L), and the change in the lake (delta S). The equation is: water surface evaporation (E) = I- O + P + R sub L + G sub L + or - delta S. A table presents monthly variations in these parameters for April 1972-March 1973. Despite Lake Ontario's large size, its local basin has a relatively small effect on its water supply because of the large volume of flow through it. Local hydrology is the principal cause of water level fluctuations. Large-volume inflows and outflows must be measured with great precision or relatively large errors may result in evaporation estimates from water balance in spring and early summer. When the storage change was positive (April-June), the lake level rose as inflow exceeded outflow; these were also months of higher local runoff. When the storage change was negative (July-October) lake level fell and outflow exceeded inflow; these months corresponded to low runoff and increased evaporation. As lake level increases, outflow also increases. (Lynch-Wisconsin)
W79-08867

INTERNAL WAVES AND ASSOCIATED CURRENTS IN LAKE ONTARIO OBSERVED DURING THE IFYGL PROGRAM,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
C. H. Mortimer.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 280-287. 2 fig, 37 ref.

Descriptors: *Lake Ontario, *Internationale Field Year for the Great Lakes(IFYGL), *Internal waves, Water temperature, Air-water interfaces, Winds, Waves(Water), Inertia, Inland seas, Gulfs, Model studies, United States, Canada, International commissions.

Water motions and air-water interactions in Lake Ontario were studied through physical measurements and modelling during the International Field Year of the Great Lakes (IFYGL); this paper reviews results from 1972 for the periods of stratification development (May-June) and full stratification (July-November). Numerous independent measurements confirmed that patterns of water motion display a wide range of forms, origins, and scales, and are strongly and characteristically influenced by lateral boundaries, earth rotation, and presence or absence of a seasonal thermocline. These findings match those for other large lakes, gulfs, and land-locked seas. The motions fall into two groups: (1) episodic oscillatory responses to wind impulses (the focus of this paper), and (2) steadier responses in the form of mean circulation patterns. Conceptual modelling of the first group based on Ekman's description is summarized, as are models of the Kelvin and Poincare wave types. A principal discovery during IFYGL was the demonstration in Lake Ontario that inertial motion in enclosed seas is generated intermittently by the combined influence of the immediate Ekman response at inertial frequency to impulsive wind stress in open waters, and the subsequent Poincare responses (resonant excitation of one or more modes with near-inertial frequencies) set in motion by pressure gradients arising from wind-induced distortiones of the nearshore thermocline interface. (Lynch-Wisconsin)
W79-08868

IFYGL CIRCULATION MODELLING AT CCIW,
Canada Centre for Inland Waters, Burlington (Ontario).
T. J. Simons.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 288-294. 3 fig, 17 ref.

Descriptors: *Lake Ontario, *International Field Year for the Great Lakes(IFYGL), *Mathematical models, *Circulation, *Lakes, *Great Lakes, Model studies, Numerical analysis, Hurricanes, Hurricane Agnes, Simulation studies, Water levels, Currents(Water), Water temperature, Winds, Stratification, Hydrology, Wind stress, Bottom drag, Heat diffusivity, Vertical eddy viscosity, United States, Canada, International commissions.

A model based on the framework established by numerical weather prediction and storm surge forecasting was developed by the Canada Centre for Inland Waters (CCIW) during the International Field Year for the Great Lakes (IFYGL) for use on large lakes (such as Lake Ontario) in computing water levels, currents, temperatures, and transport of dissolved or suspended materials. The project involved three phases: (1) survey of numerical techniques used in geophysical fluid dynamics studies, and model development; (2) verification with IFYGL data for two periods of atmospheric stress (June 1972, tropical storm Agnes, when the lake was weakly stratified, and August 1972 at the peak of stratification); and (3) long-term simulations of the physical environment and interactions with biochemical processes. Physical variables of the model are horizontal and vertical water motions, surface elevations, and temperatures, which are distributed on a staggered grid in space and time. Several other parameters represent small-scale quasi-random motions which cannot be treated by deterministic methods, including coefficients of surface wind stress and bottom drag, and vertical eddy viscosity and heat diffusivity between model layers. The model was run for the complete 1972 field year. Use of the dynamic model with plankton models resulted in realistic simulations of such essential phenomena as time lag between nearshore and deep water algal blooms in spring, and effects of upwelling and overturning during the stormy fall season. (Lynch-Wisconsin)
W79-08869

ATMOSPHERIC BOUNDRY LAYER - IFYGL,
Canada Centre for Inland Waters, Burlington (Ontario).
F. C. Elder.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978, Part 1, p 295-303. 9 fig, 15 ref.

Descriptors: *Lake Ontario, *International Field Year for the Great Lakes(IFYGL), *Atmospheric boundary layers, *Heat transfer, *Meteorological data, *Winds, *Great Lakes, Lakes, Boundary layers, Atmosphere, Eddies, Wind drag, Air temperature, Humidity, Wind velocity, Evaporation, Air-water interfaces, Circulation, Mixing, Thermal stratification, Heat budget, Energy, Heat, United States, Canada, International commissions.

The atmospheric boundary layer segment of the International Field Year for the Great Lakes (IFYGL)--concentrated on Lake Ontario--was designed to: (1) determine lake-air fluxes of heat, water vapor, momentum, and trace substances (such as sulfur dioxide), and the distribution and variability of those fluxes in space and time; (2) develop improved methods of estimating lake-air fluxes primarily using routinely available observations; and (3) produce an observational data set for testing theoretical and numerical models of the behavior of the boundary layer over the lake and its interactions with large-scale atmospheric processes and with lake circulation. The program produced an excellent file of experimental data on both micro- and mesoscale meterological fields; improved estimates of the surface energy fluxes were obtained suitable for deriving the lake's energy budget and for correlation with lake physical, chemical, and biological events. Data generally agreed with existing hypotheses, though boundary layer profiles departed significantly from overland characteristics. Atmospheric boundary layers processes interact intimately with chemical and biological lake processes: (1) the turbulent eddies of the boundary layer acting at the lake's surface determine air-water transfers of water and latent heat in evaporation and the vertical transfer of sensible heat; (2) these eddies determine heating or cooling of surface layers, and the resulting thermal structure plus surface wind stress determine lake circulation and mixing. (Lynch-Wisconsin)
W79-08870

BIOLOGY-CHEMISTRY PROGRAM DURING IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
N. A. Thomas, T. F. Nalepa, and A. Robertson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 304-310. 2 fig, 1 tab, 12 ref.

Descriptors: *International Field Year for the Great Lakes(IFYGL), *Biology, *Water chemistry, *Trophic level, *Eutrophication, *Lake Ontario, *Ecology, *Great Lakes, International commissions, United States, Canada, Lakes, Ecosystems, Bioindicators, Benthic fauna, Invertebrates, Phytoplankton, Algae, Zooplankton, Cladophora, Nutrients, Recycling, Mesotrophy, Oligotrophy, Sediments, Phosphorus, Limiting factors, Primary productivity, Succession, Seasonal, Limnodrilus hoffmeisteri, Tubifex tubifex, Stylodrilus heringianus, Water pollution effects, Water pollution sources.

Studies to characterize biological and chemical parameters of Lake Ontario during the International Field Year for the Great Lakes (IFYGL) in 1972-73 are summarized. Goals were to: (1) determine the lake's trophic status and identify problem areas, (2) describe important ecological processes, and (3) generate data for developing and verifying mathematical models. Indicator species of benthic invertebrates provided the best means of evaluating trophic levels. The eutrophic indicator species Limnodrilus hoffmeisteri and Tubifex tubifex were found in great abundance near urban areas, with the most obvious eutrophication near the mouth of the Niagara River and in the Toronto vicinity. Mesotrophic conditions were evident along the southern shore from the Niagara River to Rochester. Sylodrilus heringianus and Pontoporeia affinis were used as indicators of oligotrophy; the former dominated much of the central and north-central part of the lake. Budgets were calculated for various lake chemicals, and those for nitrogen, phosphorus, and chloride are presented. Sediment phosphorus contribution to lake water was about 10% of phosphorus loading from external sources. Both nitrogen and phosphorus limited primary productivity. The latter was much too high relative to measured nutrient depletion, and recycling is thought to have accounted for 87% of phosphorus and 69% of nitrogen uptake by phytoplankton. Phytoplankton species composition was typical of eutrophic waters, including great numbers of Stephanodiscus. (Lynch-Wisconsin)
W79-08871

ECOSYSTEM AND WATER QUALITY MODELING DURING IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
A. Robertson, and D. Scavia.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, 311-316. 5 fig, 1 tab, 7 ref.

Descriptors: *International Field Year for the Great Lakes(IFYGL), *Lake Ontario, *Mathematical models, *Ecostems, *Chemical properties, *Biological properties, *Great Lakes, Lakes, Model studies, Nutrients, Cycling nutrients, Carbon cycle, Algae, Phytoplankton, Zooplankton, Ecology, Resource management, Water management(Applied), Seasonal, Limiting factors, Benthic fauna, Invertebrates, Turnovers, Canada, United States, International commissions.

Various ecological models developed during the International Field Year for the Great Lakes (IFYGL) 1972-73, based on data from Lake Ontario, differ in detail but have basically the same framework and function in essentially the same manner. This paper describes the model developed at the Great Lakes Environmental Research Laboratory (GLERL), which simulates dynamics of a number of chemical and biological properties of Lake Ontario. It is composed of a series of differential equations describing dynamics of five phytoplankton and six zooplankton types, detritus, organic nitrogen, ammonia, nitrate, available phosphorus, silica, oxygen, the carbonate system, and benthic invertebrates. The model uses inputs of temperature, turbulent diffusivity, solar radiation, and length of photoperiod, obtained from actual measurements or by calculations based on theory. The differential equations are solved with a time step of one day to observe seasonal cycles of model compartments; this has been done for two and three vertical layers of the lake. Calculated values for sedimentation and diffusion provided estimates of exchange between layers. Spatial subdivision can be increased in the vertical or expanded into the horizontal (if horizontal water movements can be estimated). The models can: (1) estimate carbon flow among trophic compartments, (2) estimate turnover times, (3) determine factors controlling productivity, and affecting nutrient dynamics, and (4) assist in resource management. (Lynch-Wisconsin)

W79-08872

RELEVANCE OF IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
E. J. Aubert.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 317-323. 4 fig, 15 ref.

Descriptors: *International Field Year for the Great Lakes(IFYGL), *Lake Ontario, *Limnology, *Hydrology, *Water balance, *Basic data collections, *Great Lakes, Meteorology, Lakes, International cooperation, Monitoring, Evaporation, Model studies, Mathematical models, Water management(Applied), Circulation, Waves(Water), Algae, Phytoplankton, Zooplankton, Benthic fauna, Primary productivity, Internal waves, Species composition, Distribution, Abundance, Water quality, Canada, United States, International commissions.

The International Field Year for the Great Lakes (IFYGL), an experimental and theoretical research program focusing on the limnology, hydrology, and meteorology of Lake Ontario and its basin, involved scientists, engineers, and technicians from Canada and the U.S. Data was collected 1972-73. Water quantity projects dealt with the process and prediction of lake evaporation; water quality investigations were on limnological mechanisms, phenomena, and predictive and simulation modelling, and included water movements, thermal structure, nutrients, water chemistry, plankton, benthos, fish, and lake-air interactions. Effects of both natural processes and man's activities were encompassed. Results of water quantity studies: (1) the seasonal evaporation cycle was characterized by a relatively smooth and rapid transition, with a pronounced maximum September-February, and a minimum May-June; (2) the drag coefficient was dependent upon atmospheric stability; and (3) an energy balance was constructed. Water quality results: (1) for mid-lake mean calculation, a one-cell cyclonic gyre was typical of the warm season, but a two-cell counterrotating circulation also occurred, with the preference dependent upon relative magnitude of the surface wind curl and bottom shape effects; (2) intertial and near-inertial Poincare waves predominated in mid-lake, while longer-period Kelvin and topographic waves predominated within 12 km from shore; and (3) the species composition, abundance, and distribution of fauna and flora in space and time were determined. (Lynch-Wisconsin)
W79-08873

THE INFLUENCE OF PLANKTONIC AND BENTHIC CRUSTACEANS ON SILICON CYCLING IN LAKE MICHIGAN, U.S.A.,
Argonne National Lab., IL. Environmental Impacts Studies Div.
J. G. Ferrante, and J. I. Parker.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 324-328. 3 fig, 1 tab, 8 ref.

Descriptors: *Lake Michigan, *Cycling nutrients, *Silicon, *Crustaceans, *Diatoms, *Copepods, *Mysis relicta, *Boundary layers, Benthic fauna, Amphipoda, Pontoporeia affinis, Sedimentation, Sediments, Frustules, Fecal pellets, Great Lakes, Lakes, Zooplankton, Phytoplankton, Eutrophication, Chrysophyta, Grazing, Sediment-water interfaces.

Calanoid copepod and Mysis relicta fecal pellets are important in Lake Michigan for transporting fragmented diatom frustules, the major source of reactive silicon (rSi) needed for diatom production, through the metalimnion where dissolution results in accumulation of rSi in the upper hypolimnion. The rSi is effectively retained there by the metalimnion. In late summer-early fall depression of the metalimnion results in mixing of rSi-rich hypolimnetic water into the epilimnion, eventually triggering the fall diatom bloom. The increase in rSi near the sediment-water interface, shown by Conway, et al (1977), suggests a process in which amorphous silicon (aSi) is converted to rSi, possibly as the result of activity by the benthic amphipod Pontoporeia affinis, and to a lesser extent M. relicta. Feeding of these two animals in the substrate and benthic boundary layer may function in a manner similar to activity of the planktonic crustaceans in fragmenting the diatom frustules and enhancing their dissolution. For this study, data were collected along a transect extending from Grand Haven, Michigan 12.5 km southwest into the lake. Sediment traps were suspended in the hypolimnion at depths of 37 and 60 m; samples were also collected with a towed net. Paucity of frustules in lake sediment demonstrated that these decompose prior to reaching the sediment. (Lynch-Wisconsin)
W79-08874

PHOSPHORUS CYCLING AND ALGAE IN GREEN BAY, LAKE MICHIGAN,
Wisconsin Univ., Green Bay. Coll. of Environmental Sciences.
J. C. Norman, and P. E. Sager.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 329-333. 1 fig, 2 tab, 13 ref.

Descriptors: *Green Bay(Lake Michigan), *Phosphorus, *Cycling nutrients, *Phytoplankton, *Turnovers, *Eutrophication, *Lake Michigan, Fox River(WI), Bays, Great Lakes, Lakes, Nutrients, Algae, Biomass, Chlorophyll, Metabolism, Mixing, Dilution, Phosphates, Trophic level, Orthophosphate, Limiting factors, Saturation, Luxury absorption.

Trophic gradients in Green Bay, Lake Michigan, from hypereutrophic at the southern end to oligotrophic at the northern end, were used to examine phosphorus cycling rates relative to soluble phosphate availability, algal biomass, and luxury phosphorus storage by algae. The steep gradients in phosphate and phytoplankton biomass (as chlorophyll-a) along a transect extending north 15 km into the bay from the mouth of the Fox River contrasted greatly with the uniform phosphorus cycling rates between algae and water. It is suggested that similarities in turnover rates of phosphorus per unit phytoplankton biomass are due to phosphate availability at levels exceeding limiting concentrations, leading to a saturation effect in phosphorus metabolism by the phytoplankton. Variations in observed phytoplankton biomass concentrations may be accounted for by the dynamic conditions of mixing and dilution in this estuary-like body of water, and the continuous outward transport of water masses from the phosphorus-rich Fox River. It has been shown previously that an important feature of phosphorus metabolism by algae is the assimilation and rapid release of a relatively small phosphate pool; phosphate is rapidly exchanged between soluble and particulate fractions in lake water with turnover times as low as several minutes. Lean established the importance of ultraplankton in rapid phosphorus turnover by seston, and that additional soluble and colloidal compartment may participate in the exchange process. Algal utilization of phosphorus is further complicated by luxury uptake. (Lynch-Wisconsin)
W79-08875

VERTICAL AND SEASONAL DISTRIBUTION OF CHLOROPHYLL A AND NUTRIENTS IN LAKE MICHIGAN,
Wisconsin Univ.-Milwaukee. Dept. of Zoology.
A. S. Brooks, and J. A. Mortonson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 334-335. 3 ref.

Descriptors: *Lake Michigan, *Chlorophyll, *Phytoplankton, *Nutrients, *Vertical distribution, *Hypolimnion, *Eutrophication, Great Lakes, Lakes, Distribution, Seasonal, Thermal stratification, Algae, Zooplankton, Grazing, Fish, Primary productivity, Depth.

A subthermocline chlorophyll-a maximum in southern Lake Michigan contained the bulk of algal biomass during summer with significant energy transfer and nutrient cycling in this zone. This influenced phytoplankton abundance and composition in surface water during autumn (upward mixing of previously formed chlorophyll increased the chlorophyll content in the mixed layer, giving the false impression of a surface autumn bloom). The study was conducted at a 100-m deep station 27 km northeast of Milwaukee, Wisconsin April 1975-September 1976. Chlorophyll-a was homogeneous in the water column (1 mg/cu m) during winter, but increased uniformly at all depths March-May, reaching maxima of 3.8 mg/cu m by 27 May 1975 and 2.1 mg/cu m by 26 May 1976. Reactive silicon dioxide decreased concurrently 0.7 to 0.2 mg/l; uniform distributions of nitrate (0.23 mg/l), nitrite (0.001 mg/l), dissolved reactive phosphorus (0.001 mg/l), and total phosphorus (0.006 mg/l) were found. With thermal stratification in June a subthermocline chlorophyll-a peak developed between 15 and 35 m, reaching maxima of five mg/cu m by 7 July 1975 and 10 mg/cu m by 14 July 1976. SiO2 decreased to 0.1 mg/l in the epilimnion, but increased to 1.0 mg/l at 100 m; nitrate changed little, nitrite showed a distinct maximum of 0.010 mg/l just below the chlorophyll peak, and total phosphorus a maximum of 0.020 mg/l at the depth of the chlorophyll peak. The major chlorophyll-a peak collapsed in mid-August, followed by lesser peaks at 10 and 30 m. At overturn, nutrients and chlorophyll-a were once again uniformly distributed. (Lynch-Wisconsin)
W79-08876

DISSOLUTION OF DIATOM FRUSTULES AND SILICON CYCLING IN LAKE MICHIGAN, U.S.A.,
Argonne National Lab., IL.
J. I. Parker, H. L. Conway, E. M. Yaguchi, and D. N. Edgington.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 336-340. 11 ref.

Descriptors: *Lake Michigan, *Silicon, *Cycling nutrients, *Diatoms, *Frustules, *Eutrophication, *Sediment-water interfaces, Great Lakes, Lakes, Zooplankton, Grazing, Sediments, Chrysophyta, Algae, Phytoplankton, Hypolimnion, Epilimnion, Distribution, Vertical distribution, Recycling, Degradation(Decomposition), Limiting factors, Nutrients.

Most of the annual silicon requirement for diatom production in Lake Michigan is provided by diatom frustule dissolution, enhanced by zooplankton grazing. Inputs of soluble reactive silicon (rSi) from land drainage compensates for loss of frustules to the sediment, providing about 2.5-3.0% (1.66 g Si/sq m/yr) of the estimated annual diatom requirement of 53 g Si/sq m/yr; some 1.33 g Si/sq m/yr are lost to sediments. About 76-98% of frustules are dissolved before they can be incorporated into bottom sediments, possibly providing rSi to the hypolimnion by diffusion. Data was collected on monthly cruises April-December 1975 at a station west of Grand Haven, Michigan; vertical distribution of total suspended sediment and diatom abundance and biomass was measured at five-m intervals to a depth of 40 m. Maximal epilimnetic rSi levels occurred in winter-early spring, declining rapidly during developments of the May-June diatom bloom. Particulate amorphous silicon or diatom frustules (aSi) increased during the bloom, coinciding with peaks in diatom abundance and biomass. Diatom abundance declined when rSi levels fell below about 6.8 micromoles, and minimal epilimnetic total silicon levels occurred in early August with zooplankton grazing and frustule settling. By early fall advective transport of hypolimnetic rSi to the epilimnion initiated the fall diatom bloom, which peaked in October-November. (Lynch-Wisconsin)
W79-08877

SPATIAL HETEROGENEITY AND NICHE DIFFERENTIATION IN ZOOPLANKTON OF LAKE HURON,
State Univ. of New York at Albany. Dept. of Biological Sciences.
D. C. McNaught.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 341-346. 1 fig, 3 tab, 16 ref. NSF OCE75-23710.

Descriptors: *Lake Huron, *Diaptomus minutus, *Holopedium gibberum, *Zooplankton, *Ecology, *Niches, *Spatial distribution, *Vertical migration, Great Lakes, Lakes, Crustaceans, Copepods, Cladocera, Food habits, Feeding rates, Phytoplankton, Grazing, Algae, Predation, Morphology, Habitats, Herbivores, Buoyancy, Behavior, Eutrophication, Size, Competition, Langmuir circulation.

The passively drifting cladoceran Holopedium gibberum is contrasted with the actively swimming calanoid copepod Diaptomus minutus in Lake Huron to clarify ecological differences and adaptations between the two zooplankters, which represent extremes among common herbivores. Spatial heterogeneity (habitat selection and temporal behavior) is more important than selective feeding in stabilizing such natural zooplankton populations. Both species preferred small phytoplankton cells (< 22 micrometers) rather than large cells. Holopedium is surrounded by a large gelatinous sheath composed of carbohydrates (9.6% pentose) and spends little time swimming. It readily adjusts to the density of its environment, whereas Diaptomus, with a density 3% greater than water, must constantly swim to stay at the surface, but can search for food both horizontally and vertically while Holopedium passively moves at diffusion velocities (20 sq cm/sec). During daylight populations of both animals migrate downward. Holopedium populations daily harvest only 0.6% of the phytoplankton standing crop in low production areas of Lake Huron, but leave essentially no untouched food (no prey refugium). Diaptomus removes only 0.09% of the phytoplankton in sparse phytoplankton areas, being essentially adapted for feeding in high-density eutrophic areas, where it can afford to leave a large refugium. The large Holopedium (> two mm) avoids predation through bad taste, while Diaptomus does so through small size (< one mm). (Lynch-Wisconsin)
W79-08878

THE RESPONSE OF CLADOPHORA GLOMERATA TO CHANGES IN SOLUBLE ORTHOPHOSPHATE CONCENTRATIONS IN LAKE ERIE,
State Univ. of New York Coll. at Fredonia. Dept. of Geology.
K. E. Mantai.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 347-351. 3 fig, 9 ref. NSF OCE75-23710.

Descriptors: *Cladophora glomerata, *Lake Erie, *Bioassay, *Orthophosphate, *Nutrients, *Limiting factors, *Sampling, algae, Sessile algae, Chlorophyta, Filamentous algae, Great Lakes, Lakes, Growth rates, Plant growth, Seasonal, Plant physiology, Nitrates, Iron, Luxury absorption, Nitrogen, Phosphorus, Sampling, Phosphatases.

Laboratory bioassays showed that the growth pattern of the sessile, filamentous chlorophyte Cladophora glomerata in Lake Erie is complex and cannot be explained in terms of simple nutrient limitation. Neither phosphorus nor nitrate appeared limiting in this study except during short periods (such as nitrate during mid-July 1975). Some other unmeasured nutrient (possibly iron) may be rate-limiting, and Cladophora requires both thiamine and vitamin B-12 for growth in culture. High alkaline phosphatase activity does not necessarily indicate long-term phosphorus limitation, but can be the result of a change in ambient phosphate concentration. Following exposure to high phosphate pulses cells change from a luxury consumption pattern to one in which phosphate apparently is limiting based on alkaline phosphatase activity, despite the adequate phosphate in the water. After one to several days cells readapt to the lower phosphate concentration and alkaline phosphatase activity drops to a low value. When studying natural Cladophora glomerata populations in areas characterized by rapid fluctuations in environmental parameters such as in lake wave zones and rivers, frequent sampling is needed. Samples were collected in spring-summer 1975-76 at Point Gratiot, near Dunkirk, New York on Lake Erie's eastern basin. (Lynch-Wisconsin)
W79-08879

HIGH MOLECULAR WEIGHT POLYSACCHARIDES ISOLATED FROM LAKE WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
B. K. Burnison.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 353-355. 9 ref.

Descriptors: *Polysaccharides, *Bay of Quinte(Ontario-Canada), *Lake St George(Ontario-Canada), *Organic matter, *Chemical analysis, Lakes, Bays, Eutrophication, Ontario(Canada), Canada, Algae, Phytoplankton, Microcystis aeruginosa, Cyanophyta, Tracers, Phosphates, Heavy metals, High molecular weight, Analytical techniques, Methodology, Lake Ontario, Great Lakes.

Chemical analysis of high molecular weight organic material (> 300,000) showed polysaccharides are a major component of water samples collected in the eutrophic lake north of Toronto free of significant industrial influence. Such high molecular weight compounds may act as ion exchangers to transport nutrients to algal cells or they may bind heavy metal ions, thus protecting the algae from toxic concentrations. The high molecular weight material can be labelled with phosphorus-32 phosphate, but it is not known whether the P-labelled compound is identical with the polysaccharide component. The Bay of Quinte sample, collected during a bloom of the cyanophyte Microcystis aeruginosa, consisted of 80% neutral sugars by dry weight, especially galactose (40%), glucose (12%), xylose (11%), rhamnose (8%), and fucose (7%). Uronic acid was about 20% of the total. Polysaccharides varied 2-40% of total dissolved organic carbon, and was dependent on phytoplankton biomass. The polysaccharides may be solubilized sheath material from Microcystis. The Lake St. George sample differed greatly; only 30% of total dry weight of each fraction analyzed could be accounted for by neutral sugars. Maximum contribution of organic nitrogen compounds was estimated at 10%, and lipids less than 1%; about 30% was undetermined. About 21% showed some similarity to lipopolysaccharides. (Lynch-Wisconsin)
W79-08880

PHYTOPLANKTON-VOLUME-BASED PRODUCTIVITY IN THE NORTH AMERICAN GREAT LAKES AND THE ST. LAWRENCE RIVER,
Southern Illinois Univ. at Carbondale. Dept. of Botany.
N. R. Wehr, and J. Verdun.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 356-361. 3 fig, 2 tab, 7 ref.

Descriptors: *Phytoplankton, *Great Lakes, *Photosynthesis, *Volume, *Species composition, *St Lawrence River, *Diversity indices, Primary productivity, Algae, Species diversity, Lakes, Rivers, Lake Michigan, Lake Superior, Lake Huron, Lake Ontario, Lake Erie, Diatoms, Chrysophyta, Cyanophyta, Chlorophyta, Biovolume, Dominant organisms, Asterionella formosa, Tabellaria fenestrata, Coscinodiscus rothii, Fragilaria crotonensis.

Photosynthetic rates/l (P), phytoplankton biovolumes (B), P/B ratios, and species composition, dominance, and diversity are compared for the Great Lakes and St. Lawrence River based on data collected during the summers of 1969, 1971, and 1973. Lakes Superior and Michigan are upper-end lakes, and Lake Huron is a mixture of waters from the two. These three lakes exhibited relatively low values of photosynthetic rate and phytoplankton biovolume. Lake Superior was lowest (P=about 0.1 micromol CO2/l/hr, B=about 0.1 microliter algae/l), followed by Lake Huron (P=0.3, B=0.4), and Lake Michigan (P=0.8, B=0.5). A dramatic peak was observed in Lake Erie's western basin (P=6, B=5), and the rest of Lake Erie and Lake Ontario were distinctly higher than the three upper lakes (P=1.4, B=1.0), though much lower than the western basin. The St. Lawrence River exhibited high photosynthetic rates (P=9) but relatively low phytoplankton biovolume (B=0.4), resulting in a P/B ratio higher than in any of the lakes. The three upper-end lakes were dominated by the diatoms Asterionella formosa, Tabellaria fenestrata, and Fragilaria crotonensis), while Lakes Erie and Ontario were dominated by different diatoms (Coscinodiscus rothii, Melosira sp., and Fragilaria capucina) and contained dominant biovolumes of chlorophytes (Pediastrum and Cosmarium) and cyanophytes. P/B ratios showed a positive correlation with Simpson's Diversity Index. (Lynch-Wisconsin)
W79-08881

SURVIVAL VERSUS COMPETITION: EVOLUTIONARY COMPROMISES AND DIVERSITY IN THE ZOOPLANKTON,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
W. C. Kerfoot, and R. A. Pastorok.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 362-374. 7 fig, 1 tab, 37 ref. NSF GB-37631, GMS 73-06845A01, DEB 76-20238.

Descriptors: *Zooplankton, *Survival, *Competition, *Predation, *Population dynamics, *Adaptation, *Genetics, *Evolution, *Reproduction, Species diversity, Tuck Lake(WA), Lake Washington(WA), Biological communities, Size, Fish, Lakes, Washington, Limiting factors, Food habits, Fecundity, Mortality, Filter feeders, Copepods, Daphnia pulex v. minnihaha, Daphnia schoedleri, Bosmina longirostris, Diaphanosoma leuchtenbergianum, Chydorus spahericus, Mathematical models, Model studies.

Field experiments in Tuck Lake (Washington) and laboratory experiments with samples from Lake Washington (Washington) to study survival and competition among several common zooplankton species showed that compensatory defenses developed by prey of larger zooplankters result in inferior ability to compete with species of similar size. The energy costs of developing such defenses as production of spines, gelatinous sheaths, or larger eggs and neonates, or reduction of pigment to increase transparency (with resultant higher susceptibility to blue-light death) have significant effects on competitive ability and consequent effects on diversity. Predation by fish further intensifies such effects. Zooplankters investigated included Daphnia pulex v. minnihaha and D. schoedleri; Bosmina short- and long-featured 'morphs'; and Daphnia pulex, Diaphanosoma leuchtenbergianum, Bosmina longirostris, and Chydorus sphaericus. Experiments showed: (1) Lake Washington Bosmina 'morphs' with longer features and protective characteristics (such as thicker exoskeletons) survive in nature more because of resistance to predation than because of ability to compete for shared resources. (2) Daphnia and other Tuck Lake zooplankton persist in backwater not because they are better competitors but because of larger size and thicker carapace. It is concluded that selective predation may serve to stabilize species associations in homogeneous open-water environments. (Lynch-Wisconsin)
W79-08882

DOCUMENTING A SEASONAL CHANGE FROM PHOSPHORUS TO NITROGEN LIMI-

TATION IN A SMALL TEMPERATE LAKE, AND ITS IMPACT ON THE POPULATION DYNAMICS OF ASTERIONELLA,
Washington Univ., Seattle. Dept. of Zoology.
J. T. Lehman, and C. D. Sandgren.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 375-380. 4 fig, 6 ref.

Descriptors: *Asterionella formosa, *Phosphorus, *Nitrogen, *Limiting factors, *Egg Lake(WA), *Population dynamics, *Eutrophication, *Seasonal, Phytoplankton, Algae, Seasonal, Chlorophyll, Washington, Lakes, Temperate, Nutrients, Stratification, Nuphar, Potamogeton, Macrophytes, Dominant organisms, Water chemistry, Succession, Diatoms, Chrysophyta.

Initial growth of the diatom Asterionella formosa in April 1976 prior to its spring bloom in Egg Lake in San Juan Island, Washington, was limited by phosphorus, while decline of the alga following its peak on 7 May was due to low nitrogen and reduced mixing in the water column from intensified stratification. Nitrogen limitation for Asterionella is noteworthy since silicon and phosphorus are currently emphasized as major factors governing growth of the diatom. Ability of this species to respond so well to added phosphorus may in fact have been responsible for its becoming the dominant planktonic species when nitrogen supplies became exhausted. Toward the end of April there began a net influx of phosphorus into the water column (specifically the surface layer) which coincided with development of submerged (Potamogeton) and emergent (Nuphar) macrophytes. Added initially to a phosphorus-limited plankton, most of the phosphorus was absorbed into the particulate fraction, and the increase in particulate phosphorus was paralleled by an increase in Asterionella cell numbers. Subsequent nitrogen limitation resulted in sinking diatoms removing sufficient particulate phosphorus from the water column to significantly reduce lake total phosphorus, despite continued lateral phosphorus inputs. In late May-June diatoms were replaced by slow-sinking, primarily flagellated algal species. (Lynch-Wisconsin)
W79-08883

DIEL VERTICAL MIGRATION AND DYNAMICS OF ZOOPLANKTON BIOMASS IN THE EPILIMNION OF CASTLE LAKE, CALIFORNIA,
California Univ., Davis. Div. of Environmental Studies.
G. W. Redfield, and C. R. Goldman.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 381-387. 4 fig, 1 tab, 14 ref. NSF BM 74-02246 A01 and DEB 76-19524.

Descriptors: *Castle Lake(CA), *Diel migration, *Vertical migration, *Zooplankton, *Epilimnion, *Biomass, Lakes, California, Biorhythms, Feeding rates, Grazing, Seasonal, Daphnia rosea, Holopedium gibberum, Diaptomus novamexicanus, Cladocera, Copepods, Species composition, Juvenile growth stage, Succession, Growth stages, Diurnal, Nocturnal, Migration.

Study of diurnal, nocturnal, and migratory zooplankton biomass in the epilimnion of dimictic, subalpine Castle Lake in the Klamath Mountains of northern California in 1975-76 showed evening ascent had a distinct effect on epilimnetic biomass, with nocturnal levels 290-346% of midday levels. Biomass ascending into the epilimnion generally followed total biomass, thought it was greatly affected by behavior of species and by age classes. Migratory biomass (the difference between diurnal and nocturnal values) was influenced by changes in vertical distribution, community composition, nutrition, and weather. Samples of the dominant species, Daphnia rosea, Holopedium gibberum, and Diaptomus novamexicanus were separated into adults and juveniles. A Diaptomus-Holopedium-Daphnia succession was observed June-September, representing a shift toward greater nocturnal/diurnal ratios. Diurnal biomass remained relatively stable seasonally, while nocturnal biomass steadily increased. Data were separated into McAlliser's continuous and nocturnal grazing schemes. In Castle Lake juvenile-dominated diurnal zooplankton constituted continuous grazers, while adult-dominated migratory biomass represented nocturnal grazers. High night grazing rates resulting from diel vertical migration may have improved efficiency and utilization of primary production by reducing losses through night respiration and allowing relatively unimpeded daylight growth. (Lynch-Wisconsin)
W79-08884

NITRATE UPTAKE BY PHYTOPLANKTON: MEASUREMENTS UTILIZING THE RADIOTRACER 13N,
California Univ., Davis. Div. of Environmental Studies.
R. M. Gersberg, R. P. Axler, K. Krohn, N. Peek, and C. R. Goldman.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 388-392. 2 fig, 1 tab, 18 ref. NSF BM 74-02246 A01, DEB 76-19524.

Descriptors: *Nitrates, *Phytoplankton, *Absorption, *Methodology, *Measurement, *Tracers, *Analytical techniques, Mrak Pond(CA), Castle Lake(CA), California, Lakes, Ponds, Algae, Nitrogen, Radioactivity, Radiochemical analysis, Cycling nutrients, Equations, Testing procedures.

A new technique is described for measuring phytoplankton nitrate uptake rates using the radiochemical nitrate-13, which has measured rates as low as 4.5 ng N/hr in oligotrophic Castle Lake, California. Initial experiments were conducted at eutrophic Mrak Pond at the University of California-Davis. Nitrogen-13 allows measurements over very short time intervals and low reaction rates without significantly raising substrate concentration. Subsurface water samples were collected from Mrak Pond and prefiltered to remove zooplankton. Nitrate-13 (at about 20 m/Ci) was pumped into 400 ml of the water, and 10-ml aliquots were filtered, rinsed, and analyzed for soluble nitrate. Filter radioactivity was counted with a NaI(Tl) crystal detector with an amplifier and single channel analyzer (SCA). Nitrogen-13 decays by emission of positrons, which yield two 0.511 MeV gamma rays. With the SCA window set to detect only gamma rays of this energy, the output logic pulse was used to drive a scaler. Calibration standards were prepared, and solution activity determined by counting 10 ml of filtrate in an ion chamber and by depositing 0.5 ml of filtrate onto Whatman-I filters and counting as with the particulate filters. NaI(Tl) crystal-detected counts were corrected for post-filtration decay, and for the aliquot factor; data provided a graph of N-13 activity accumulation in the total particulate fraction over time. A differential equation is provided for calculating uptake rate. (Lynch-Wisconsin)
W79-08885

AN EVALUATION OF RECENT SEDIMENT FOCUSING INCASTLE LAKE (CALIFORNIA) USING A VOLCANIC ASH LAYER AS A STRATIGRAPHIC MARKER,
Oklahoma Univ., Norman. Dept. of Zoology.
B. L. Kimmel.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 393-400. 3 fig, 1 tab, 25 ref. NSF DEB 76-19524.

Descriptors: *Sediment focusing, *Castle Lake(CA), *Volcanic ash, *Depth, *Slopes, *Lake morphology, *Sedimentation, Sediments, California, Lakes, Paleoecology, Paleolimnology, Winds, Turbulence, Circulation, Stratification, Mixing, Cores, Stratigraphy.

Sediment focusing, or net movement of sedimented materials from shallower to deeper water, occurs in sheltered Castle Lake in northern California's Klamath Mountains, but is a function not only of water depth (geometric focusing) but also of proximity to steep bottom slopes or irregularities of shape. Basin morphology is thus the primary determinant of sediment focusing extent, since wind-driven mixing in Castle Lake is minimal relative to many other holomictic lakes. A light-colored layer of volcanic ash below the sediment surface provides a convenient stratigraphic marker for determining the thickness of recent sediments. Sediment thickness generally increases with water depth at stations ranging 14-36 m, increasing from 46 cm at the shallowest station to 55-62 cm at four of the five 35-36 m stations. Several anomalies were observed, however. At one of the 36-m stations 66 cm of sediment accumulated even though it was located in the same vicinity as the other deep-water stations, and at station J, located near a submerged moraine, 60 cm of sediment accumulated in only 17 m of water. Within-station variance in sediment thickness was low (less than 5%) at four stations where two or three cores were taken. The existence of sediment focusing shows that choice of coring stations is critical if representative samples are to be obtained. Low-frequency echosounders may provide a good method for determining sediment accumulation patterns and for selecting sampling sites. (Lynch-Wisconsin)
W79-08886

SURVIVAL OF APHIOTIC PHYTOPLANKTON IN LAKE TAHOE THROUGHOUT PROLONGED STRATIFICATION,
California Univ., Davis. Inst. of Ecology.
W. Vincent.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 401-406. 1 fig, 3 tab, 11 ref. NSF DEB 76-11095.

Descriptors: *Stratification, *Lake Tahoe(CA NV), *Phytoplankton, *Aphotic zone, *Survival, *Deep-water habitats, Algae, California, Nevada, Chlorophyll, Lakes, Depth, Mixing, Photosynthesis, Light intensity, RuDPCase, Ribulose 1.5-diphosphate carboxylase, Euphotic zone, Eutrophication, Dormancy, Darkness, Sedimentation, Enzymes, Settling velocity, Oligotrophy, Vertical distribution.

Phytoplankton deep in the aphotic zone of Lake Tahoe (California, Nevada) during periods of thermal stratification which may exceed 12 mo, are not in a state of true physiological dormancy, but are photosynthetically primed for reentry into euphotic waters upon lake mixing. In the 350-450 m stratum, chlorophyll content did not change significantly December 1975-May 1977, indicating little exchange between the deep aphotic zone and overlying waters, even during surface mixing in early 1976. Algae collected from the deep zone began photosynthesizing immediately upon reexposure to euphotic light levels, but photosynthetic rates did not increase with up to 116 hrs of further preincubation in the light. Ribulose 1.5-diphosphate carboxylase (RuDPCase), the enzyme catalyzing the rate-determining step of the dark reactions (reductive pentose phosphate cycle) of photosynthesis, did not differ statistically in concentration per unit microbial biomass between communities of the deep aphotic zone and the euphotic zone. Settling velocities for six aphotic algae isolated into unialgal culture and measured over a wide range of nutritional conditions were too slow to account for a recent euphotic origin of these cells by passive sedimentation. Species included Choricystis sp., a Chlorosphaeralean, Chlorella saccharophila var. saccharophila, Stichococcus chodati, Monoraphidium contortum, and Fragilaria crotonensis. (Lynch-Wisconsin)
W79-08887

PREDICTIONS OF PRODUCTIVITY CHANGES IN LAKE TAHOE AT INCREASING PHYTOPLANKTON BIOMASS,
Konstanz Univ. (Germany, F. R.). Limnology Inst.
M. M. Tilzer.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August

1977. Vol. 20, September 1978, Part 1, p 407-413. 3 fig, 2 tab, 22 ref.

Descriptors: *Phytoplankton, *Lake Tahoe(CA NV), *Primary productivity, *Eutrophication, *Biomass, *Water pollution effects, *Forecasting, Algae, Lakes, California, Nevada, Photosynthesis, Chlorophyll, Trophic level, Nutrients, Oligotrophy, Secchi disks, Transparency, Limiting factors, Nitrates, Regression analysis, Shading.

Regression analysis applied to primary productivity parameters monitored in 1974 in ultraoligotrophic Lake Tahoe (California, Nevada) facilitated predictions of changes in phytoplankton photosynthesis which would accompany increasing phytoplankton biomass (chlorophyll-a) with eutrophication of the lake. Photosynthetic profiles would become compressed vertically but photosynthetic rates per unit volume would rise. An increment of chlorophyll-a from 0.1 to 10 mg/cu m would lead to only a 14-fold increase in average photosynthetic rates in the trophogenic zone, and due to self-shading integral photosynthesis would rise by no more than 80%. With increased phytoplankton biomass, light extinction would increase rapidly, but nonplant light extinction would also rise with enrichment of detritus, bacteria, zooplankton, and dissolved organic matter. A shift toward green in lake color would decrease light extinction, as would an increase in average phytoplankter size. At present maximum winter concentrations of nitrate-nitrogen, the main limiting nutrient, are extremely low (13 mg/cu m); since increases which may be significant for phytoplankton growth are hardly detectable; primary productivity has been used as a measure of changes over the past 18 years, during which productivity has increased about 60%. Data from other lakes are included for comparison. (Lynch-Wisconsin)
W79-08888

AN AUTORADIOGRAPHIC INVESTIGATION OF THE SEASONAL PHOTOSYNTHETIC ACTIVITY OF THREE DIATOM SPECIES IN LAKE TAHOE, CALIFORNIA-NEVADA,
Oak Ridge National Laboratory, TN.
B. J. Dozier, and J. J. Beauchamp.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 414-418.

Descriptors: *Lake Tahoe(CA NV), *Autoradiography, *Limiting factors, *Diatoms, *Phytoplankton, *Photosynthesis, California, Nevada, Lakes, Algae, Chrysophyta, Stephanodiscus astraea, Fragilaria crotonensis, Cyclotella stelligera, Regression analysis, Seasonal, Oligotrophy, Nitrates, Phosphorus, Water temperature, Light intensity, Nutrients, Films, Succession, Zooplankton, Grazing, Methodology.

Seasonal photosynthetic activity of three dominant diatom species in ultraoligotrophic Lake Tahoe (CA, NV) was measured by autoradiography, in 1975. The influence of water temperature, light available for photosynthesis, nitrate nitrogen, and total phosphorus on species-specific variation in photosynthetic activity was analyzed by stepwise multiple regression. Declining phytoplankton populations in Lake Tahoe were precipitated by an unfavorable change in the physico-chemical environment rather than by zooplankton grazing, since in all three cases population reduction followed declining photosynthetic activity. Data also support the overriding influence of nitrate nitrogen over phosphorus as a limiting nutrient in Lake Tahoe. Of the four parameters, water temperatures was the most ciritcal affecting photosynthetic rate at 50 m of Stephanodiscus astraea, while nitrate nitrogen was the most important for Cyclotella stelligera, and to a lesser extent Fragilaria crotonensis. For all three species temperature correlated inversely with photosynthetic activity. Algal samples were injected with carbon-14 sodium bicarbonate solution with an activity of 9.2 microCi/ml. Incubated and filtered samples were packaged with Kodak AR10 Autoradiographic Stripping Plates and exposed for 3-6 weeks; five proved optimal. Results were evaluated according to silver grain density. (Lynch-Wisconsin)
W79-08889

ANNUAL VARIATION OF PHOTOSYNTHETIC PARAMETERS IN LAKE TAHOE,
CH2M/Hill, Inc., San Francisco, CA.
N. J. Williams.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 419-425. 4 fig, 1 tab, 12 ref. NSF-RANN GI-22, AEN 74-22675.

Descriptors: *Lake Tahoe(CA NV), *Photosynthesis, *Primary productivity, *Vollenweider models, *Steele equation, *Light intensity, *Equations, Forecasting, Annual, Lakes, California, Nevada, Succession, Species composition, Limiting factors, Parameters, Chlorophyll, Model studies, Mathematical models, Seasonal, Water management(Applied), Water temperature, Nitrates.

The Steele (1962) and Vollenweider (1965) equations relating primary production to light intensity were fitted to the annual cycle of primary production in ultraoligotrophic Lake Tahoe (California, Nevada), based on 1974 data. Both equations account for the occurrence of photoinhibition at high light intensities. The Vollenweider equation was adjusted for the Steel parameters maximum production/chlorophyll and optimum light intensity, and another parameter was added, the initial slope of the light production curve. The two equations explained about 90% of total annual variation in specific production. Equation parameters showed systematic and significant annual variation which correlated with environmental conditions. The best-fit optimum light intensities showed dramatic seasonality. Optimum light intensity was controlled by average light intensity in the mixed layer, the initial slope by nitrate concentration, and maximum specific production by nitrate and temperature. By relating the parameters to the environmental conditions it was possible with the Vollenweider equation to account for 44% of the observed variation in specific production, and 67% with the Steele equation. Steele equation terms include production/chlorophyll, light intensity, maximum production/chlorophyll, and light intensity at which production/chlorophyll = maximum production/chlorophyll. The Vollenweider equation includes production/chl, light intensity, a production parameter, a light parameter, and light inhibition parameters. (Lynch-Wisconsin)
W79-08890

THE DEEP CHLOROPHYLL LAYER OF LAKE TAHOE,
California Univ., Davis. Div. of Environmental Studies.
P. J. Richerson, M. Lopez, and T. Coon.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 426-433. 2 fig, 20 ref. NSF BMS 75-14273.

Descriptors: *Lake Tahoe(CA NV), *Chlorophyll, *Deep water, *Phytoplankton, *Diatoms, *Cyclotella ocellata, California, Nevada, Lakes, Oligotrophy, Shading, Algae, Cyclotella stelligera, Biomass, Depth, Vertical distribution, Chrysophyta, Zooplankton, Photosynthesis, Primary productivity, Grazing, Nutrients, Respiration, Settling velocity, Water temperature.

Six hypotheses offered by several authors to explain the occurrence in lakes of deep chlorophyll maxima in the vicinity of the compensation depth were evaluated with 1976-77 data for ultraoligotrophic Lake Tahoe (California-Nevada). All six fit Lake Tahoe to some degrees, but none too strongly. Shade adaptation was surprisingly unimportant. The six hypotheses are: (1) The layer may be a by-product of shade adaptation; chlorophyll per unit cell biomass may increase with depth, but not biomass itself. (2) Zooplankton biomass may be higher above the maximum and grazers may prune the upper part of the profile. (3) Better nutrient conditions at depth may permit biomass to accumulate despite low photosynthetic rates. (4) Lower respiration rates could permit differential biomass accumulation at depths; such lower rates could be due to low temperatures or secondarily to better nutrient conditions which favor cells with smaller surface-to-volume ratios. (5) The layer could result from differential sinking rates of cells in nutrient-poor surface waters compared with nutrient-rich deeper waters. (6) Eucaryotic cells may be able to compete with bacteria for organic substrates at low temperatures, and it has been shown that heterotrophic uptake is a very strong function of temperature in Lake Tahoe. The Lake Tahoe epilimnion is consistently dominated by the very small diatom Cyclotella stilligera, while at the deep maximum (peak at 105 m) the much larger C. ocellata was dominant. (Lynch-Wisconsin)
W79-08891

ANOMALOUS PRIMARY PRODUCTION CONDITIONS IN SOME COLORADO ALPINE LAKES, U.S.A.,
Colorado Univ., Boulder. Dept. of Biology.
R. W. Pennak.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 434-437. 3 tab, 9 ref.

Descriptors: *King Lake(CO), *Yankee Doodle Lake(CO), *Black Lake(CO), *Primary productivity, *Testing procedures, *Dissolved oxygen, Colorado, Lakes, Phytoplankton, Algae, Diatoms, Zooplankton, Alpine, Water temperature, Methodology, Depth, Seston, Hardness(Water), Respiration, Oligotrophy, Polyarthra, Kellicottia longispina, Ceratium hirundinella, Daphnia ambigua, Peridinium, Synedra, Asterionella, Oocystis, Dinobryon.

Anomalous primary production data from light-dark bottle experiments in King, Yankee Doodle, and Black Lakes in the Rocky Mountain Front Range near Boulder, Colorado, are associated with low water temperatures, soft water, low phytoplankton and zooplankton densities, low seston, and microbiological phenomena; however, no conclusive explanations have been found. Of 25 data sets, 23 showed greater oxygen production in dark bottles than in corresponding light bottles. The greatest 24-hr increase was 1.41 ppm at a depth of 8 m in King Lake. Thirteen of the light bottles showed decreases in dissolved oxygen over starting values, with no depth correlation, and dark bottles showed greater average oxygen production below three m than above three m. It is recommended that light-dark bottle determinations in cold oligotrophic lakes be done with great care, and that even atypical results be reported. Such results have generally been dismissed in the past as experimental errors, apparently not the case. Though phytoplankton data for King and Yankee Doodle Lakes suggest considerable productivity potential, all species are small and seston quite low, as in other alpine lakes of the region. Zooplankton in the two lakes is extremely sparse, dominated by Polyarthra and Kellicottia longispina. Black Lake is dominated by Ceratium hirundinella, Daphnia ambigua, Peridinium, and Volvox. (Lynch-Wisconsin)
W79-08892

GROUND-WATER COMPONENT OF LAKE WATER AND NUTRIENT BUDGET,
Geological Survey, Denver, CO.
T. C. Winter.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 438-444. 3 fig, 6 ref.

Descriptors: *Groundwater, *Nutrient budgets, *Hydrologic budget, *Lakes, *Methodology, *Analytical techniques, Measurement, Aquifers, Runoff, Water table, Wells, Theoretical analysis, Equations, Surface runoff, Precipitation(Atmospheric), Evaporation, Streamflow, Seepage, Watersheds(Basins), Lake morphology.

The interrelationship of lakes and groundwater are analyzed with particular reference to errors implicit in considering groundwater either as unimportant in lake water and nutrient budgets, or as the residual of the budget equations. Serious errors and misinterpretations concerning these budgets arise because: (1) overland runoff, (nonchannelized surface flow) into the lake is rarely considered, and (2) errors in the measured parameters of inflow (usually precipitation and streamflow) and outflow (usually evaporation and streamflow) rarely are considered separately. Both factors thus become part of the residual along with groundwater. Recent theoretical studies show that the presence or absence of a continuous local groundwater flow system boundary beneath a lake controls whether or not there is outseepage from the lake. Continuity of the flow system boundary is controlled by the configuration of the water table in the lake drainage basin and by the permeability contrasts within the groundwater system. These studies have helped develop field analysis techniques for lake-groundwater interrelationships leading to realistic estimates of groundwater in lake water and nutrient budgets. Groundwater sampled from a well near the lake may not be related to the lake if the well is completed in a regional flow system passing at depth beneath the lake. (Lynch-Wisconsin)
W79-08893

ALGAL REMAINS IN MINNESOTA LAKE TYPES: A COMPARISON OF MODERN AND LATE-GLACIAL DISTRIBUTIONS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
T. L. Crisman.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 445-451. 4 fig, 1 tab, 14 ref.

Descriptors: *Minnesota, *Lakes, *Paleolimnology, *Algae, *Sediments, *Trophic level, *Analytical techniques, Bioindicators, Pediastrum, Distribution, Depth, Water chemistry, Hydrogen ion concentration, Conductivity, Primary productivity, Eutrophication, Oligotrophy, Palynology, Paleontology, Hardness(Water), Gloeotrichia, Botryococcus, Peridinium, Staurastrum, Glaciology, Spruce trees, Pine trees, Factor analysis.

Data on distribution of 11 taxa of nondiatom algae in surficial sediments from 96 Minnesota Lakes in terms of water depth, lake chemistry, and productivity were used in paleolimnological reconstrations based on fossil algal assemblages from late- and post-glacial lake cores as six Minnesota sites. Principal component analysis was employed to divide the taxa into associated groups. Three major factors were identified, with 82% of variance explained by the first two factors. Gloeotrichia, Pediastrum boryanum, P. duplex, P. simplex, and P. kawraiskyi display maximal loading on Factor 1. Factor 2 is defined by strong positive loadings for Peridinium, Botryococcus, Pediastrum araneosum, and P. integrum, which respond positively to low pH and alkalinity, and secondarily to low productivity. Staurastrum is the sole taxon represented by Factor 3; Pediastrum tetras does not load strongly on any factor. Distribution of the 11 taxa is controlled more by water chemistry and productivity than by water depth. Peridinium and Botryococcus dominates fossil assemblages in soft-water oligotrophic lakes, but are replaced by Pediastrum in hard-water eutrophic lakes. All six sites are characterized by a Pediastrum peak during the late-glacial spruce zone, then a decline following early postglacial replacement of spruce by pine. Domination of the peak by P. boryanum and P. duplex indicates increased productivity and conductivity. (Lynch-Wisconsin)
W79-08894

MINERAL RELEASE FROM THE LITTER OF BIDENS CERNUA L., A MUDFLAT ANNUAL AT EAGLE LAKE, IOWA,
Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.
C. B. Davis, and A. G. van der Valk.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 452-457. 2 fig, 1 tab, 17 ref.

Descriptors: *Eagle Lake(IA), *Bidens cernua, *Degradation(Decomposition), *Litter, *Minerals, *Mud flats, Lakes, Prairie, Iowa, Wetlands, Marsh plants, Macrophytes, Emergent plants, Drawdown, Aluminum, Iron, Nutrients, Phosphorus, Dry marsh phase, Calcium, Lake stages.

Stems of the emergent marsh macrophyte Bidens cernua killed by a severe frost at Eagle Lake, Iowa (a typical prairie glacial marsh lake), decomposed very slowly, releasing nitrogen, phosphorus, and calcium gradually over several years. Aluminum and iron were actually accumulated in the litter and only magnesium was released faster than dry weight was lost. Stems were collected on 14 October 1974 (three days after the frost) during drawdown of the lake initiated in spring 1974 to allow emergent species to reestablish. Stems were oven-dried at 80C, cut into 20-cm segments, and placed in nylon mesh bags (50 g/bag). On 20 November 1974 39 bags were randomly distributed on the marsh floor. Lake water level returned to normal in 1975, and from March-July of 1975 and 1976 the study area was covered by about 15 cm water. Standing water disappeared during summer, but litter remained moist and the litter zone was probably aerobic during most of the study. Sample bags were collected at six-week intervals during the 1975 and 1976 growing seasons and analyzed. Soft pitch and epidermal tissues decomposed first, with a 23% wt loss fall 1974-spring 1975. Fibrous structural and vascular tissues broke down gradually; 50% wt loss did not occur until 578 days, and 73% until 724 days. On 9 October 1976 378% of initial aluminum content remained (corrected for wt loss), 349% of iron, 90% of nitrogen, 80% of calcium, 53% of phosphorus, and 17% of magnesium. Prairie glacial marsh 5-20 yr cycles are discussed. (Lynch-Wisconsin)
W79-08895

PHOSPHORUS RELEASE FROM LAKE SEDIMENTS AS AFFECTED BY CHIRONOMIDS,
Wisconsin, Univ.-Madison. Lab. of Limnology.
G. W. Gallepp, J. F. Kitchell, and S. M. Bartell.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 458-465. 2 fig, 2 tab, 19 ref. NSF AG-199, BMS 76-00761.

Descriptors: *Chironomidae, *Chironomus riparius, *Lake Mendota(WI), *Phosphorus, *Cycling nutrients, *Mud-water interfaces, *Sediments, Lakes, Wisconsin, Madison(WI), Oxidation-reduction potential, Benthic fauna, Mortality, Mud, Aerobic conditions, Darkness, Nutrients, Epilimnion, Eutrophication, Soluble reactive phosphorus, Insects, Larvae.

Larvae of the chironomide Chironomus riparius released six mg total phosphorus/sq m/day in mud collected from University Bay of Lake Mendota, Madison, Wisconsin; maintenance of such a rate during summer would provide a steady and significant amount of phosphorus to the epilimnetic community. Two experiments were conducted to determine the effect of C. riparius on phosphorus release from lake sediment. Chironomids were added to filtered lake water and mud in darkness and under aerobic conditions. After six days median total phosphorus level was 28 microg/l in tubes with no chironomids, 92 microg/l with 10 individuals, and 114 microg/l with 25 individuals. Testing for mortality during the second experiment showed 40% during the first week, which may explain the gradual decrease in phosphorus observed in the first experiment. Phosphorus movement between sediment and water is known to be affected by benthic organisms, including bacteria, algae, and tubificids, but burrowing larval chironomids have been neglected. These larvae are uniquitous and dominant in benthos of eutrophic lakes where phosphorus loading is of great concern. Chironomids increase sediment oxygen penetration, and increase the redox potential of surface mud layers. Sediment was collected from the upper 10-20 cm of the bay's substrate in 4-6 m water, and C. riparius from the Madison sewage outfall. Tests were conducted in polycarbonate tubes 48 cm long and 6.9 cm inside diameter. (Lynch-Wisconsin)
W79-08896

SEASONAL IMPACT OF PLANKTIVORY ON PHOSPHORUS RELEASE BY LAKE WINGRA ZOOPLANKTON,
Wisconsin Univ.-Madison. Lab. of Limnology.
S. M. Bartell, and J. F. Kitchell.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 466-474. 5 fig, 2 tab, 20 ref. NSF AG-199, BMS 76-00761.

Descriptors: *Lake Wingra(WI), *Zooplankton, *Sunfishes, *Predation, *Phosphorus, *Cycling nutrients, Lakes, Wisconsin, Madison(WI), Eutrophication, Fish, Fish food organisms, Size, Lepomis macrochirus, Daphnia galeata, Model studies, Bosmina longirostris, Cyclops bicuspidatus, Diaptomus siciloides, Feeding rates, Food habits, Cladocera, Copepods, Statistical models, Seasonal, Limnetic zone.

Predation by bluegill sunfish (Lepomis macrochirus) reduces phosphorus release from limnetic zooplankton by one order of magnitude in eutrophic Lake Wingra (Madison, Wisconsin) during June and July when predation reaches its seasonal maximum and allochthonous phosphorus supplies are seasonally low. The impact of predation on four dominant zooplankton species was calculated using statistical models and population estimates. Species were Daphnia galeata, Bosmina longirostris, Cyclops bicuspidatus, and Diaptomus siciloides, which account for over 90% of zooplankton biomass in the lake. Both the quantity of zooplankton consumed and size-selectiveness influence phosphorus availability in the lake's limnetic zone. Phosphorus release rate by zooplankton is inversely related to animal size, and therefore large size-selective predation increases phosphorus released per unit zooplankton biomass. In Lake Wingra bluegill predation changes both size distribution and standing crop of zooplankton, but during June-August any increase in specific release rate is offset by a reduction in biomass, which decreases phosphorus release rate at the system level. Zooplankton were collected weekly in 1972 and monthly in 1973 at 0.5-m depth intervals. Monthly bluegill collections were made by bottom trawling, and stomach contents analyzed to determine zooplankton consumption. (Lynch-Wisconsin)
W79-08897

LEAF LITTER IN GULL LAKE, MICHIGAN, U.S.A.,
Brigham Young Univ., Provo, UT. Dept. of Zoology.
J. R. Barnes, R. Ovink, and K. W. Cummins.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 475-479. 1 fig, 1 tab, 14 ref.

Descriptors: *Litter, *Leaves, *Gull Lake(MI), *Degradation(Decomposition), *Depth, *Shredders, Organic matter, Michigan, Lakes, Metabolism, Hickory, White oak, Eutrophication, Leaching, Water temperature, Amphipoda, Hyalella azteca, Gastropods, Chironomidae, Copepods, Ostracoda, Physa, Pycnopsyche, Caddisflies, Aquatic animals, Invertebrates.

Processing of five-g packs of hickory (Carya glabra) and white oak (Quercus alba) leaves anchored at depths of 2.5, 6.0, and 12.0 m in large, eutrophic Gull Lake, Michigan, was investigated 72-85 days, April-July 1975, with sampling every 300 degree days. Dissolved organic matter leaching was the same for each species at each depth despite differing mean temperatures of 19 C at 2.5 m, 17 C at 6.0 m, and 9 C at 12.0 m. Hickory leaves lost about 10% more weight due to leaching than did oak leaves at each depth. Hickory was processed faster than oak at both 2.5 and 6.0 m depths,

and was faster for each at 2.5 m than at 6.0 due probably to differences in shredder faunal densities and temperature, and more mechanical breakage at 2.5 m due to greater water movement. Processing rates of both species were similar at the 12.0 m depth and considerably slower than at the other depths, influenced by the lack of shredders. Chironomids were the most abundant organisms at 2.5 and 6.0 m, except between days 40-65 when large numbers of small amphipods (Hyalella azteca) and gastropods were dominant. Presumed shredders included the caddisfly Pycnopsyche sp., the amphipods Gammarus sp. and H. azteca, and the snail Physa sp. None was found at 12.0 m except an occasional amphipod; dominant organisms were chironomids, copepods, and ostracods. Percent ash-free dry wt after 72-85 days was 2% (2.5 m), 20% (6.0 m), and 86% (12.0 m) for hickory, and 47%, 70%, and 88% for oak. (Lynch-Wisconsin)
W79-08898

ROLE OF INVERTEBRATE PREDATION IN STRUCTURING ZOOPLANKTON COMMUNITIES,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
P. A. Lane.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978, Part 1, p 480-485. 3 tab, 16 ref. NSF GB 33337.

Descriptors: *Zooplankton, *Biological communities, *Invertebrates, *Predation, *Gull Lake(MI), *Eutrophication, *Methodology, *Dyes, Cyclops bicuspidatus, Lakes, Michigan, Fluorescent dyes, Copepods, Cladocera, Mortality, Cannibalism, Size, Daphnia, Diaptomus, Bosmina longirostris, Tropocyclops prasinus, Mesocyclops edax, Leptodora kindtii, Chaoborus, Epischura lacustris, Diaphanosoma leuchtenbergianum.

Predation among zooplankton in the limnetic zone of large, eutrophic Gull Lake, Michigan, is widespread and important. Complex interrelationships among eight predator and nine prey species, determined by fluorescent staining, are described. Predators include Diaptomus oregonensis, D. minutus, Epischura lacustris, Tropocyclops prasinus, Mesocyclops edax, Cyclops bicuspidatus, Leptodora kindtii, and Chaoborus spp. Prey include Daphnia galeata, D. retrocurva, D. dubia, D. longiremis, Diaphanosoma leuchtenbergianum, Bosmina longirostris, Diaptomus spp., T. prasinus, and C. bicuspidatus. With nutrient enrichment C. bicuspidatus has become dominant due in part to its efficient predation dynamics. It readily attacks prey larger than itself, feeds in groups, is cannibalistic, and preys heavily on diaptomids, which may help explain their marked decline. T. prasinus may be a better predator on some cladocerans than C. bicuspidatus but is probably controlled by Cyclops predation. The predators are generalist feeders, consuming a wide variety of prey; notable are T. prasinus, C. bicuspidatus, L. kindtii, and Chaoborus spp. Calanoid copepods generally had lower predation rates than cyclopoids or larger seizers. The major vertibrate planktovore in Gull Lake is the smelt Osmerus mordax. Rhodamine B has been found to be the best fluorescent stain, and freezing the best preservation method. (Lynch-Wisconsin)
W79-08899

EFFECTS OF A HYPOLIMNETIC APPLICATION OF ALUMINUM SULFATE TO A EUTROPHIC LAKE,
Kent State Univ., OH. Dept. of Biological Sciences.
G. D. Cooke, and R. H. Kennedy.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 486-489. 2 fig, 3 tab, 9 ref. EPA R801936.

Descriptors: *Eutrophication, *West Twin Lake(OH), *Alum, *Sediments, *Hypolimnion, *Lake restoration, *Phosphorus, *Water pollution treatment, East Twin Lake(OH), Ohio, Lakes, Glacial lakes, Nutrients, Limiting factors, Nutrient loading, Alkalinity, Water pollution sources, Littoral, Epilimnion, Sorption, Aluminum hydroxide, Flocculation.

Application of alum to the hypolimnion of eutrophic West Twin Lake, northeastern Ohio, in July 1975 successfully lowered total lake phosphorus to one-third the pretreatment high, but continued eutrophic symptoms indicate littoral phosphorus sources are more important than hypolimnetic sediments. Treatment was effective through November 1976 when monitoring was terminated. Continuing net internal phosphorus loading, smaller than expected reduction in epilimnetic phosphorus levels, and persisting high algal standing crop point to significant epilimnetic phosphorus sources, probably including macrophytes, fish, and epilimnetic sediments. Anaerobic sediments in the hypolimnion had very low phosphorus release rates after treatment. In small lakes like West Twin with low limnetic/littoral ratios and protection against large seiches, the littoral is probably the most important internal phosphorus source. Hypolimnetic sediments were thought to be West Twin Lake's primary source of internal phosphorus loading. In cases of excessive allochthonous phosphorus loading alum is unlikely to be effective in reducing eutrophic symptoms. Alum controls sediments phosphorus through the sorptive capacity of the aluminum hydroxide floc formed in alkaline water. The maximum alum dose was applied to WTL, that amount which can be added before residual dissolved aluminum exceeds 0.05 mg Al/l. Adjacent East Twin Lake, untreated, served as control. (Lynch-Wisconsin)
W79-08900

RELATIONSHIP BETWEEN PHOSPHORUS LOADING AND PHYTOPLANKTON STANDING CROPS IN CHAUTAUQUA LAKE, NEW YORK,
State Univ. of New York Coll. at Fredonia. Environmental Resources Center.
T. A. Storch, W. M. Barnard, and W. J. Metzger.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 490-495. 4 fig, 11 ref.

Descriptors: *Chautauqua Lake(NY), *Nutrient loading, *Phosphorus, *Phytoplankton, *Forecasting, *Trophic level, New York, Lakes, Algae, Chlorophyll, Standing crops, Flushing rate, Nutrients, Limiting factors, Nitrogen, Methodology, Analytical techniques, Eutrophication, Mesotrophy, Lake restoration, Water pollution control, Transparency, Secchi disks, Bioassay, Water pollution sources.

A plot summer phytoplankton standing crop (chlorophyll-a) versus annual phosphorus loading in meso-eutrophic Chautauqua Lake, New York, according to Bachmann and Jones (1974) reliably predicted the lake's response to a 40% reduction in phosphorus loading to the northern basin in 1976 through control of industrial discharges. The reduction produced a 44% decline of chlorophyll-a in July-August from 7.3 mg/cu m in 1975 to 4.1 mg/cu m in 1976, compared with a predicted 48% decrease to 3.8 mg/cu m based on the plot. Data indicate that for the lake's more eutrophic southern basin both point and nonpoint phosphorus sources must be controlled to significantly improve water quality. The southern basin has a flushing rate five times higher than that of the northern basin. Bioassays in 1975-76 showed phosphorus was limiting in both basins much of the year, but nitrogen was colimiting July-December and was the major limiting nutrient in the northern basin September-December. Chlorophyll-a levels are 4-7 times higher in the southern basin than in the northern. Bachmann and Jones' generalized plot for 14 U.S., Canadian, and Swedish lakes does not necessarily apply to the individual lakes, and separate prediction lines must be constructed for each lake because of differences in lake flushing rate, amount of phosphorus available to phytoplankton, and interactions between phytoplankton and nutrients. (Lynch-Wisconsin)
W79-08901

INFRARED IMAGERY AND THERMAL TRANSECTS OF ONONDAGA LAKE, NEW YORK,
State Univ. of New York at Buffalo. Dept. of Biology.
K. M. Stewart.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 496-501. 3 fig, 13 ref.

Descriptors: *Onondaga Lake(NY), *Infrared radiation, *Remote sensing, *Thermal transects, *Thermal scanners, *Aerial photography, *Water pollution sources, New York, Lakes, Water temperature, Plumes, Saline lakes, Thermal radiation, Sewage disposal, Industrial wastes, Soda ash, Isotherms, Thermal pollution.

Surface thermal transects and aerial infrared imagery of relatively saline Onondaga Lake, northwest of Syracuse, New York, were used to study disposition of fluid discharges from the Metropolitan Sewage Treatment Plant (MSTP) and the Soda Ash Manufacturing Company (SAMC). Infrared imagery was collected using aircraft equipped with HRB Singer infrared line scanner systems with detectors capable of operation in the 3-5 and 8-14 micron band range, allowing recording of true thermal imagery day or night. Thermal transects were taken lengthwise along a northwest-southeast center line. The MSTP discharges treated sewage from the southeast shore and from an outfall at a depth of 6.1 m some 520 m from shore; SAMC thermal discharges enter the lake nearby. Effects of discharges from both plants were apparent in the images and in the transects, though the latter did not pass directly over either discharge. The most dense input was from Nine Mile Creek waters after entertainment of fluids draining from SAMC waste beds. Transects from March 1969 show irregular isotherms under partial ice conditions, with a prominent subsurface plume from MSTP discharges and a thin heated surface layer, probably from the SAMC. Infrared images from December 1970 show the SAMC thermal plume and the relatively warm discharges from the MSTP. Use of these and other techniques, including satellite imagery, enhance understanding of lake dynamics. (Lynch-Wisconsin)
W79-08902

LONGITUDINAL CHANGES IN THE WATER CHEMISTRY OF LAKE CHAMPLAIN,
Vermont Univ., Burlington. Dept. of Zoology.
M. Potash, and E. B. Henson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 502-506. 3 fig, 8 ref.

Descriptors: *Lake Champlain(NY), *Water chemistry, *Dilution, *Conductivity, *Alkalinity, *Nutrients, Cations, Sodium, Magnesium, Potassium, Calcium, Tributaries, New York, Lakes, Sedimentation, Lake morphometry.

Water chemistry data collected 1965-74 show that a 1969 analysis of a dilution effect observed in Lake Champlain was oversimplified. The consistent decrease in concentrations of several parameters in the 164 km from the southern source to the northern outlet was earlier attributed to dilution by waters of lower concentration entering from the northeasterly regions of Malletts Bay, the Northeast, and Missisquoi Bay. However, new data indicate the dilution effect occurs in the main lake considerably south of the entry of northeastern waters, at Thompson's Point and Reference Station sampling sites, located 80-100 km from the source. A lake becoming more dilute from source to outlet is unusual, especially since the lateral tributaries contribute waters which invariably exceed adjacent lake waters in concentration. Though causes are unknown, it is thought that biological utilization and physicochemical sedimentation are major factors. Decreases in alkalinity and conductivity from origin to outlet were most abrupt in the southern region between Five-Mile Point and Crown Point, and also between Crown Point and Thompson's Point. Calcium, magnesium, and po-

tassium decreased relatively regularly from south to north, with larger decreases in the former two 40-55 km from the source. Sodium increased for the first 40 km, then decreased steadily thereafter. (Lynch-Wisconsin)
W79-08903

ECOLOGY OF A LAKE CHAMPLAIN WETLAND TRANSECT,
Vermont Univ., Burlington. Dept. of Zoology.
E. B. Henson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 507-509. 2 fig, 1 tab.

Descriptors: *Lake Champlain, *Munson's Flats(VT), *Ecology, *Wetlands, *Invertebrates, *Macrophytes, Lakes, Ecosystems, Vermont, Water chemistry, Detritus feeders, Herbivores, Production, Consumption, Distribution, Hirudinea, Chironomidae, Odonata, Snails, Amphipods, Flatworms, Sparganium, Phalaris arundinacea, Scirpus fluviatilis, Potamogeton, Myriophyllum, Equisetum, Zizania aquatica, Wild rice.

A north-south transect 1975-77 through Munson's Flats, a wetland area on the edge of Lake Champlain 16 km north of Burlington, Vermont, showed: (1) Animals were most abundant and had the most taxa in the submergent-floating zone, were least abundant and had fewer taxa in the harsh emergent zone, and were intermediate in the channel draining the wetland into the lake. (2) Primary consumers were the most abundant fauna in the emergent zone (47%). (3) Detritus feeders were the most abundant fauna in the submergent-floating zone (80%) and in the channel (82%). Production in the emergent zone apparently exceeded consumption, with the reverse true in the submergent-floating zone. In the emergent zone 29% of fauna were secondary consumers and 24% detritus feeders, in the submergent-floating zone 8% were primary and 12% secondary consumers, and in the channel 5% were primary and 13% secondary consumers. The emergent zone contained 34 animals in 15 taxa, the submergent-floating zone 682 animals in 19 taxa, and the channel 286 animals in 18 taxa. Invertebrates were collected in wire baskets containing burreed (Sparganium) and left in the wetland for one month. Vegetation was characterized (south to north) by a sloping land for one month. Vegetation was characterized (south to north) by a sloping meadow dominated by reed canary grass (Phalaris arundinacea), which grew down into the water; an area of burreed, river bull rush (Scirpus fluviatilis), Potamogeton, and Myriophyllum south of the channel; and Equisetum and buttonbush north of the channel. Wild rice (Zizania aquatica) was found in 1975 and 1977. (Lynch-Wisconsin)
W79-08904

AN INVESTIGATION OF THE EFFECTS OF PULP AND PAPER EFFLUENT ON THE MACROBENTHIC COMMUNITY IN SOUTHERN LAKE CHAMPLAIN, U.S.A.,
Vermont Dept. of Water Resources, Montpelier.
C. W. Pagel, and C. A. Wade.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 510-513. 2 fig, 5 ref.

Descriptors: *Lake Champlain, *Benthic fauna, *Pulp and paper industry, *Water pollution effects, *Species composition, *Spevies diversity, *Industrial wastes, Lakes, New York, Effluents, Tubificids, Oligochaetes, Polychaeta, Midges, Mayflies, Limnodrilus hoffmeisteri, Pisidium, Hexagenia limbata, Chironomidae, Sphaeriidae, Bioindicators, Succession, Suspended solids, Phosphorus, Biochemical oxygen demand, Aluminum sulfate, Polymers.

Initiation of a new pulp and paper plant in the southern Lake Champlain area (Ticonderoga Bay) in December 1970 with discharges of an effluent averaging 62,370 cu m/day substantially reduced or eliminated about two-thirds of the 50 species of benthic macrofauna of the lake area, while greatly increasing organism density. April densities increased from 1892 organisms/sq m in 1972 to 7304 in 1973 and 42,980 in 1975, then declined to 11,234 in 1977. Prior to 1970 benthic macrofauna was dominated by the mayfly Hexagenia limbata (65%); these were reduced to 16% in 1972, eliminated by 1975, but reappeared again in 1977. Oligochaeta, mainly the immature tubificid Limnodrilus hoffmeisteri, increased from 2% in 1972 to 54% in 1973 and 93% in 1975, falling to 80% in 1977. Chironomidae composed almost half of the population in 1972, but declined to 14% in 1973 and 2% in 1977. Sphaeriidae declined from 18% in 1972 to 2% in 1977. Species diversity was lowest (0.65) in July 1974 when problems were experienced in the treatment facility, and low values also resulted from introduction of alum and polymers to reduce suspended solids in the effluent 1974-76; suspension of such applications in fall 1976 subsequently improved species diversity. The effluent contains an average of 32.4 kg/day phosphorus, 7580 kg/day suspended solids, and 1283 kg/day BOD. Population changes of Procladius, Peloscolex, Pisidium, Sphaerium, Manayunkia, and Chaoborus are also discussed. (Lynch-Wisconsin)
W79-08905

LOW MOLECULAR WEIGHT DISSOLVED ORGANIC MATTER IN FIVE SOFT-WATER ECOSYSTEMS: A PRELIMINARY STUDY AND ECOLOGICAL IMPLICATIONS,
Toledo Univ., OH. Dept. of Biology.
H. L. Allen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 514-524. 3 fig, 2 tab, 18 ref. NSF GB-35374.

Descriptors: *Low molecular weight, *Organic matter, *Eutrophication, *Ponds, *Indicators, *Trophic level, *Ultraviolet radiation, *Primary productivity, Oligotrophy, Mesotrophy, Dystrophy, Post Pond(NH), Golf Course Pond(NH), Occom Pond(NH), Mud Pond(NH), Star Lake(VT), Nutrients, New Hampshire, Vermont, Hardness(Water), Analytical techniques, Stability, Refractivity, Lakes, Aquatic plants, Algae.

Low molecular weight (LMW), organic compounds separated from total dissolved organic matter (TDOM) in four soft-water New Hampshire ponds and one small soft-water Vermont lake were exposed to high-intensity ultraviolet light; results indicated pattern differences in labile and refractory characteristics may be indicators of differences in productivity and trophic state. Cluster patterns revealed by LMW pool size and oxidation potentials differed among the water bodies apparently in relationship to differences in rates of production, transformation, and decomposition of LMW material (<500). Poorly productive Post Pond has a variable-sized total dissolved organic carbon (TDOC) pool related to the large SA/V ratio of the basin and low external inputs; the small LMW fraction is mostly refractory and contributes to suppressed primary productivity. Moderately productive Golf Course Pond receives significant nutrient additions; macrophytes, epiphytes, benthic flora, and open-water populations all contribute to the TDOC pool and to the larger LMW fraction. Eutrophic Star Lake has a high TDOC pool, and its qualitative variable LMW fraction has a relatively large portion of labile compounds. Hypereutrophic Occum Pond has a large TDOC pool, and the LMW pool contains a large labile fraction and may be quantitatively more variable than in Star Lake. Poorly productive Mud Pond has high TDOC levels accompanied by a large LMW fraction consisting mostly of refractory materials. (Lynch-Wisconsin)
W79-08906

SESTON SEDIMENTATION IN MIRROR LAKE, NEW HAMPSHIRE, AND ITS RELATIONSHIP TO LONG-TERM SEDIMENT ACCUMULATION,
Cornell Univ., Ithaca, NY. Langmuir Lab.
R. E. Moeller, and G. E. Likens.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 525-530. 1 fig, 1 tab, 14 ref.

Descriptors: *Mirror Lake(NH), *Seston, *Sedimentation rates, *Cores, *Nutrient budgets, *Estimating, Lakes, New Hampshire, Oligotrophy, Sediments, Gyttja, Palynology, Nutrients, Cycling nutrients, Eutrophication, Infilling, Nitrogen, Phosphorus, Carbon, Magnesium, Sulfur, Calcium.

Three methods are compared for estimating the almost imperceptible sedimentation rate in small, oligotrophic Mirror Lake, New Hampshire: (1) short-term collections of sedimenting seston, (2) dated sediment cores, and (3) nutrient budgets which compute the difference between annual inputs and outputs of the lake. Pollen-dated sediment cores yield long-term rates, while input-output budgets are sensitive to small measurement inaccuracies. Seston sedimentation into collecting jars placed one meter above the gyttja which fills the basin was relatively uniform during the summers of 1973-75, with overall mean 0.69 g dry wt/sq m/day. A mean annual sedimentation rate of 176 g/sq m/yr was calculated for the deep 10-m station by extending summer rates through autumn turnover. Calculated annual deposition of acid-insoluble ash (diatoms and mineral particles primarily) agreed well (93%) with the mean rate since 1900 derived from the core and assumed to be relatively constant. Over the past 70 years sedimentation has been 121 g/sq m/yr. Though dry-matter accumulation has not differed from the precultural state, nitrogen, sodium, potassium, and aluminum have increased significantly. Total dry matter decomposes and is remobilized at a rate of 36%. Chemical elements undergo remobilization from surface sediments at varying rates: N, 69%, P, 62%; C, 50%, Mg 40%; S and Ca, 32%; K, 17%, Al, 14%, and Na, 3%. (Lynch-Wisconsin)
W79-08907

ACIDIFICATION OF MAINE (U.S.A.) LAKES BY ACIDIC PRECIPITATION,
Maine Univ. at Orono. Dept. of Botany and Plant Pathology.
R. B. Davis, M. O. Smith, J. H. Bailey, and S. A. Norton.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 532-537. 2 fig, 19 ref.

Descriptors: *Acid precipitation, *Maine, *Lakes, *Acidic water, *Hydrogen ion concentration, *Water pollution sources, *Baseline studies, Water pollution effects, Alkalinity, Acidity, Environmental effects, Precipitation(Atmospheric), Sampling.

Summer pH in 1368 Maine lakes decreased from an average of 6.85 in 1937 to an average 5.95 in 1974 (an eight-fold increase in acidity), with about 75% of the decrease occurring 1950-60, when precipitation acidity is thought to have increased the most. Data are based on 1936 pH readings taken at the water surface with Wallace-Tiernan colorimetry until the 1960s, and thereafter with portable pH meters; the methods agree within 0.1 pH units. Hydrogen ion concentration increased an estimated average of 1,000,000 M 1937-74 in the lakes. These results are the first demonstration of pH decrease due to acid precipitation in a large U.S. lowland lake region. Because of the relatively moderate decrease in pH no biological effects have been noted in the Maine lakes, but in several Norwegian, Swedish, and Canadian lakes more severe acidification has resulted in severe effects on fish and other biota. Precipitation acidity has generally been greater in western than in eastern or northern Maine, and regional variations in amounts of precipitation and in seasonal patterns of precipitation and runoff have influenced lake pH. To verify overall averages, a subset of the 258 lakes for which there are pH readings for more than one year was analyzed separately. The subset had a mean alkalinity of 11.4 + or - 12.6 ppm as CaCO3 and a maximum of 88 ppm, typical of the entire data set. (Lynch-Wisconsin)

W79-08908

PALEOLIMNOLOGIC EVIDENCE FOR INCREASED ZINC LOADING IN LAKES OF NEW ENGLAND, U.S.A.,
Maine Univ. at Orono. Dept. of Geological Sciences.
S. A. Norton, R. F. Dubiel, D. R. Sasseville, and R. B. Davis.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 538-545. 3 fig, 1 tab, 22 ref.

Descriptors: *New England, *Lakes, *Zinc, *Cores, *Paleolimnology, *Sedimentation, *Heavy metals, Acid precipitation, Palynology, Water pollution sources, Trophic level, Geology, Hydrogen ion concentration, Alkalinity, Sedimentation rates, Annabessacook Lake(ME), China Lake(ME), Long Pond(ME), Maranacook Lake(ME), Moosehead Lake(ME), Sebasticook(ME), Sebago Lake(ME), Seymour Lake(VT), Columbia Lake(CT), Granite Lake(NH), Lashaway Lake(MA), Beach Pond(CT-RI).

Chemical analysis of pollen-dated sediment cores from 12 New England lakes showed zinc content in the lakes had grown much higher in the past two centuries, regardless of morphology, trophic status, or activities in the drainage basin. An initial increase was noted in sediments deposited about 1800-1900 A.D., and a second about 1910-20. The first increase is attributed to atmospheric precipitation, and the second to widespread introduction of galvanized metal into the drainage basin. Zinc is transported to the lakes and sedimented (particulates), chemically absorbed on iron-manganese oxides, or precipitated as a sulfide within the sediment. Sebasticook Lake, Maine, has been grossly loaded with zinc over the past 30 years from zinc sulfate derived from herbicides. It is possible that floral and faunal changes evident in the recent paleolimnological record were caused by increased flux of zinc and other heavy metals associated with acid precipitation, rather than to climatic changes or point sources as has been thought. Cores were taken from Annabessacook, China, Maranacook, Moosehead, Sebasticook, and Sebago Lakes, and Long Pond, Maine; Columbia Lake, Connecticut; Granite Lake, New Hampshire; Lashaway Lake, Massachusetts; Seymour Lake, Vermont; and Beach Pond, Connecticut-Rhode Island. The lakes range from oligotrophic to eutrophic, have maximum depths of 6.1-96.5 m, and their alkalinity varies from 6-29 ppm CaCO3. The cultural-precultural boundary was taken as the rise of weed pollen (Ambrosia and Rumex). (Lynch-Wisconsin)
W79-08909

RESPONSE OF A SOFT WATER LAKE IN NORTH FLORIDA, U.S.A., TO INCREASED CHEMICAL AND PARTICULATE LOADING FROM ITS WATERSHED,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, R. R. Turner, and R. C. Harriss.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 546-549. 8 ref.

Descriptors: *Lake Jackson(FL), *Watersheds(Basins), *Water pollution sources, *Nutrient budgets, *Water pollution effects, *Urbanization, Lakes, Florida, Hardness(Water), Phosphorus, Nitrogen, Chlorides, Silicon, Particulates, Urban runoff, Water chemistry, Fisheries, Largemouth bass, Micropterus salmoides, Tributaries, Alkalinity, Conductivity, Eutrophication, Phytoplankton, Algae.

Nutrient budgets for Lake Jackson, in northern Florida, indicate that urbanization has substantially increased phosphorus inputs and reduced silicon inputs, and suburbanization has markedly increased nitrogen inputs. Urban development on two arms of the lake has significant reduced water quality locally, and continued urban development in the watershed is likely to degrade water quality in the entire lake to the point of destroying the largemouth bass (Micropterus salmoides) fishery. Budgets were constructed for inputs of phosphorus, inorganic nitrogen, chloride, silicon, and particulate matter to the 1515-ha closed-basin lake, based on unit-area loadings derived from three representative subwatersheds, selected sampling of all tributary streams, and the amount and chemical composition of precipitation. Adverse changes in water quality have included increases in alkalinity (from four to over 50 mg/l CaCO3), specific conductance (from 27 to over 100 micromhos/cm), phytoplankton production (from an average of 32 mg C/cu m/hr to 147 mg), molybdate reactive phosphorus (from two to 23 microg P/l), and winter nitrate and ammonia concentrations, and highly increased sedimentation rates. The subwatersheds represented urban, suburban, and mixed forest-agriculture. Total phosphorus inputs to the lake were 12,930 kg/yr, 4% derived from rain and the rest from runoff, of which 49% was from urban areas. Of inorganic nitrogen, 66% (3305 kg/yr) was derived from rainfall. (Lynch-Wisconsin)
W79-08910

BIOLOGICAL LAYERING RESULTING FROM EXTREME MEROMICTIC STABILITY, DEVIL'S HOLE, ABACO ISLAND, BAHAMAS,
State Univ. of New York at Buffalo. Div. of Biology.
K. H. Goehle, and J. F. Storr.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 550-555, 4 fig, 1 tab.

Descriptors: *Devil's Hole(Bahama Islands), *Solution holes, *Meromixis, *Water chemistry, *Biological communities, *Chemocline, Pigments, Bacteria, Sulfur bacteria, Lakes, Caves, Bahama Islands, Food chains, Mixolimnion, Salinity, Water temperature, Dissolved oxygen, Stability, Phytoplankton, Algae, Zooplankton, Chlorophyll.

The chemocline of Devil's Hole and small, very stable meromictic lake on Greater Abaco Island, Bahama Islands studied 1965-74, contains many organisms with similar pinkish pigmentation, and there is a strong interrelationship between the biological community and the chemistry of the layer. The solution hole, though inland, has a connection to the sea, and is nearly circular, 24-30 m in diameter and 50 m deep; water in the upper 15 m is primarily fresh. The chemocline at a depth of about 15-21 m is unique in having major differences in concentrations of several chemicals compared with higher and lower layers. Major biological activity in the chemocline occurs 15-18 m, coinciding with a temperature peak at 18 m and an oxygen peak at 16 m. Maximum salinity occurs 17-22 m. The thermal increase in the chemocline is believed due to a greenhouse effect or to activity of the bacterial plate, probably composed of Chlorobium, Chromatium, and Thiocystis, green and red sulfur bacteria. Bacterio-chlorophyll-d and accessory pigments give cells a reddish-brown to magenta-pink color, which zooplankton take on by ingesting the bacteria, and the mysid Eurthrops elegans from ingesting zooplankton. Rainout from the biologically rich mixolimnion apparently supplies nutrients to chemocline organisms. The mixolimnion contains diatoms and other phytoplankton, zooplankton, crabs, small fish, and large diving beetles. (Lynch-Wisconsin)
W79-08911

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS, I. A STRATEGY FOR COMPARISON,
Wisconsin Univ.-Madison. Dept. of Botany.
O. L. Loucks, and W. E. Odum.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 556-561, 6 tab, 12 ref. NSF DEB 76-82283.

Descriptors: *Findley Lake(WA), *Marion Lake(BC-Canada), *Mirror Lake(NH), *Lawrence Lake(MI), *Lake Wingra(WI), *Limnology, *Baseline studies, Lakes, Ecosystems, Hydraulic residence time, Nutrient loading, Nutrient budgets, Nutrients, Phosphorus, Nitrogen, Lake morphology, Watersheds(Basins), Water chemistry, Land use, Geology, Hydrogen ion concentration, Canada, Washington, New Hampshire, Michigan, Wisconsin.

This paper introduces an eight-part comparative limnological study of five mostly similar U.S. and Canadian lakes representing a variety of hydrological, chemical, and biological characteristics. The study focused on the flux of materials between land and lake, and their processing in the lake. The lakes, which included Findley (Washington), Marion (British Columbia), Mirror (New Hampshire), Lawrence (Michigan) and Wingra (Wisconsin), were similar in latitude (42-49 degrees N), size (5-15 cu m in area except Wingra, 137 cu m but shallow), and altitude (213-300 m, except Findley at 1200 m). All were dimictic except polymictic Marion. Differences in basin, physical and morphological, and chemical characteristics yielded a series of treatments or gradients. The comparative approach adopted provides a more rigorous means of evaluating processes and controls in lake ecosystems. Differing variables included basin size (34-13,000 ha), average annual rainfall (80-270 cm), annual hydrologic inflow (41-57 million cu m), renewal time (0.014-1.0 yrs), maximum depth (6-27 m), and proportion of lake in littoral (almost none to large). Chemistry varied as a function of substrate geology, vegetation, and land use; calcareous Lawrence and Wingra had high pH (7.4-8.5), total alkalinity (100-250 mg/l), ammonium (10-1000 mg/cu m), and nitrate nitrogen (1-2500 mg/cu m). Total phosphorus loadings ranged from 0.15-0.96 g/sq m/yr, and Marion and Wingra had high organic inputs. (Lynch-Wisconsin)
W79-08912

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS. II. THERMAL ENERGY AND MECHANICAL STABILITY,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
N. M. Johnson, J. S. Eaton, and J. E. Richey.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 562-567, 2 fig, 1 tab, 6 ref.

Descriptors: *Lakes, *Stability, *Energy, *Heat budget, *Thermodynamics, Advection, Convection, Heat transfer, Water temperature, Water circulation, Latent heat, Heat, Computer programs, LIMNO, Algorithms, Classification, Birgean work, Winds, Schmidt stability, Flushing rate, Findley Lake(WA), Marion Lake(BC-Canada), Mirror Lake(NH), Lawrence Lake(MI), Lake Wingra(WI), Baseline studies.

Five standard energy parameters--annual heat budget, mean annual temperature, Birgean wind work (B), Schmidt stability (S), and water renewal--together provide a practical and useful technique for describing lake energy characteristics, demonstrated with five Canadian and U.S. lakes. A general algorithm, LIMNO, utilizes a computer to calculate annual heat budget, Schmidt stability, and Birgean work. B is the amount of mechanical work exerted on or by a lake through its surface to produce the observed density distribution, and S is the subsequent amount of work needed to mix the lake to uniform density without gaining or losing heat. Lakes studied were Findley (Washington), Marion (British Columbia), Mirror (New Hampshire), Lawrence (Michigan), and Wingra (Wisconsin). Conclusions: (1) Wingra and Marion are one order of magnitude less stable (10- g-cm/sq cm) than Findley, Lawrence, and Mirror (100 g-cm/sq cm); (2) Mirror and Lawrence are virtually identical in overall thermal and convective regimes; (3) in Findley, the coldest lake, latent heat is the dominant term in the heat budget; (4) though winter stability is uniformly low for all lakes (S 10 g-cm/sq cm), ice cover prevents exertion of B on the water column; (5) advection dominates Marion circulation (about 76 renewals/yr) compared to Wingra, Lawrence, and Mirror (1-2 renewals/yr);

and (6) Mirror is the most stagnant. (Lynch-Wisconsin)
W79-08913

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS. III. SOURCES, LOADING AND FATE OF NITROGEN AND PHOSPHORUS,
Cornell Univ., Ithaca, NY. Dept. of Ecology and Systematics.
G. E. Likens, and O. L. Loucks.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 568-573, 6 tab, 6 ref.

Descriptors: *Nitrogen, *Phosphorus, *Nutrient budgets, *Water pollution sources, *Path of pollutants, *Lakes, Nutrient loading, Nutrients, Cycling nutrients, Forest watersheds, Watersheds(Basins), Metabolism, Ecosystems, Sediments, Tributaries, Streams, Precipitation(Atmospheric), Particulates, Flushing rate, Land use, Findley Lake(WA), Mirror Lake(New Hampshire), Lake Wingra(WI), Washington, New Hampshire, Wisconsin, Litter, Baseline studies.

Study of nitrogen and phosphorus budgets in Findley Lake (Washington), Mirror Lake (New Hampshire), and Lake Wingra (Wisconsin) showed that: (1) nutrient input levels generally reflected land use, watershed area, vegetation, and geology; (2) precipitation inputs were significant and sometimes dominant; (3) lacustrine sediments were a sizable sink for nitrogen and phosphorus; (4) retention times for nitrogen and phosphorus may be determined by factors other than water renewal time; and (5) insect emergence may account for significant loss of nitrogen and phosphorus from lake ecosystems. Patterns of short-term nutrient loading and losses need further study at the ecosystem level. Data were not sufficient to test the hypothesis that lakes in forested watersheds receive the majority of their inputs of nitrogen and phosphorus from direct precipitation and gases, whereas runoff dominates in open grassland or disturbed watersheds. Data for Findley were from 1975, for Wingra averages from 1970-74, and for Mirror averages from 1968-75. Wingra is located in a grassland area and receives urban drainage from Madison, Wisconsin, while Findley and Mirror have forested watersheds. Wingra had by far the largest inputs of phosphorus (0.96 g/sq m/yr) and nitrogen (23.59 g/sq m/yr), but among the lakes proportions added from precipitation, fluvial, and litter sources were remarkably similar. Evapotranspiration was much more important than drainage area size in determining annual fluvial water input to the lakes. (Lynch-Wisconsin)
W79-08914

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS. IV. ALLOCHTHONOUS CARBON INPUTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
W. E. Odum, and R. T. Prentki.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 574-580, 5 fig, 16 ref.

Descriptors: *Carbon, *Water pollution sources, *Lakes, *Nutrient loading, *Watersheds(Basins), *Tributaries, Lake Wingra(WI), *Findley Lake(WA), Marion Lake(BC-Canada), Mirror Lake(NH), Lawrence Lake(MI), Nutrient budgets, Physical properties, Hydraulic residence time, Particulates, Organic loading, Streams, Particulate organic carbon, Dissolved organic carbon, Litter, Precipitation(Atmospheric), Vegetation, Shores, Baseline studies.

The amount and importance of allochthonous organic carbon inputs to five small North American lakes were controlled primarily by fluvial input, in turn influenced by watershed-lake area ratios, annual precipitation, watershed runoff, and presence or absence of permanent inlet streams. In general, allochthonous carbon is probably most important in carbon budgets of small oligotrophic lakes with relatively large watersheds and moderate-to-high annual precipitation. With short lake retention time much of the allochthonous carbon may be flushed through the system. Secondary factors influencing inputs are shoreline development and length of forested shoreline. Heterotrophic lakes are most likely to exist where autochthonous production is severely limited by physical or chemical factors. Lakes studies were Findley Lake (Washington), Marion Lake (British Columbia, Canada), Mirror Lake (New Hampshire), Lawrence Lake (Michigan), and Lake Wingra (Wisconsin). When fluvial inputs were high, dissolved organic carbon (DOC) tended to exceed particulate organic carbon (POC). Litter input of organic carbon was of secondary importance, influenced by length of wooded shoreline and type of vegetation. Precipitation was also a secondary source of organic carbon, but factors affecting the amount of such inputs are unknown. Although Marion Lake has an extremely high fluvial input of organic carbon, its short retention time results in a relatively low net allochthonous input. Deepening the lake, thereby increasing retention time, would radically alter this input. (Lynch-Wisconsin)
W79-08915

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS. V. PRIMARY PRODUCTION AND COMMUNITY STRUCTURE,
Washington Univ., Seattle. Fisheries Research Inst.
A. H. Devol, and R. C. Wissmar.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 581-586, 2 fig, 2 tab, 22 ref.

Descriptors: *Lakes, *Model studies, *Primary productivity, *Nutrient loading, *Phosphorus, *Flushing rate, Phytoplankton, Macrophytes, Epiphytes, Biological communities, Ecosystems, Findley Lake(WA), Marion Lake(BC-Canada), Mirror Lake(NH), Lawrence Lake(MI), Lake Wingra(WI), Nitrogen, Nutrients, Vollenweider models, Mathematical models, Algae, Depth, Periphyton, Trophic level, Cycling nutrients, Sediments, Baseline studies.

Total primary productivity and especially phytoplankton productivity in five small North American lakes appeared related to total phosphorus loading, modified by flushing rate, but factors regulating production by macrophytes and periphytes were obscure. Lakes studied were Findley (Washington), Marion (British Columbia, Canada), Mirror (New Hampshire), Lawrence (Michigan), and Wingra (Wisconsin). One reason the total phosphorus loading-flushing rate approach fails to completely explain total productivity is because it neglects significant phosphorus pools and cycling within the lake ecosystem itself. Phosphorus concentrations in sediments are generally much higher than in overlying water, and in the short run are not directly dependent on total loading. Furthermore, both macrophytes and epiphytic algae effectively extract phosphorus from sediments, whereas phytoplankton are entirely dependent on water column phosphorus levels, largely a function of external loading. For the five lakes phytoplankton production was a better parameter than total production for establishing a relationship with phosphorus loading and flushing rate. Vollenweider's 1968 loading-mean depth model classifies oligotrophic Marion and Findley Lakes as eutrophic due to omission of the lakes' high flushing rates. Dillon's corrected model (1975) incorporating both flushing rate and phosphorus retained in the lake correctly predicts trophic status of all lakes except Marion. (Lynch-Wisconsin)
W79-08916

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS. VI. CONSUMER COMMUNITY STRUCTURE AND PRODUCTION,
Washington Univ., Seattle. Fisheries Research Inst.
R. C. Wissmar, and R. G. Wetzel.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part I, p 587-597, 2 fig, 3 tab, 20 ref. NSF DEB 76-82283.

Descriptors: *Carbon, *Zooplankton, *Fish, *Benthic fauna, *Insects, *Lakes, *Productivity, *Food habits, *Ecosystems, Findley Lake(WA), Marion Lake(B.C.-Canada), Mirror Lake(NH), Lawrence Lake(MI), Lake Wingra(WI), Faunal lists, Detritus, Carnivores, Herbivores, Habitats, Ecology, Niches, Invertebrates, Nutrient budgets, Carbon cycles, Baseline studies.

The potential influence of autochthonous and allochthonous organic carbon sources upon invertebrate and vertebrate consumer community structure and production was investigated in five North American lakes, Findley (Washington), Marion (British Columbia, Canada), Mirror (New Hampshire), Lawrence (Michigan), and Wingra (Wisconsin). Zooplankton, insects, and fish were considered, and a list of major species with feeding modes and preferred habitats is given. Conclusions: (1) detrivorous invertebrates were the most important consumers in all five lakes, and in more productive systems with high phytoplankton production there were increased levels of zooplankton production relative to insect production; (2) fish communities of the more-productive ecosystems (Lawrence, Wingra) showed stronger niche complementarily due to segregation by habitat and food size; these lakes and more diverse and productive vegetative habitats that supported prey organisms of high abundance, availability, and diversity; (3) low zooplankton and insect turnover rates in less-productive lakes may have been due to less energy being utilized for production as a result of greater respiratory and maintenance costs; and (4) low trophic transfer efficiencies in the more-productive ecosystems implies a greater diversion of energy to benthic communities. (Lynch-Wisconsin)
W79-08917

ANALYSIS OF FIVE NORTH AMERICAN ECOSYSTEMS. VII. SEDIMENT PROCESSING,
Connecticut Univ., Storrs. Biological Sciences Group.
P. H. Rich, and A. H. Devol.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 598-604, 2 fig, 2 tab, 13 ref.

Descriptors: *Sediments, *Degradation(Decomposition), *Carbon dioxide, *Oxygen, *Respiratory quotient, *Organic matter, *Energy conversion, Lakes, Findley Lake(WA), Marion Lake(BC-Canada), Mirror Lake(NH), Lawrence Lake(MI), Lake Wingra(WI), Trophic level, Metabolism, Respiration, Methodology, Analytical techniques, Oxidation-reduction potential, Electron transport, Microorganisms, Thermodynamics, Baseline studies.

Respiratory quotients (RQ), the ratio of carbon dioxide produced to oxygen removed, were derived for organic matter decomposition in sediments of five small North American lakes: Five small North American lakes were studied, Findley (Washington), Marion (British Columbia, Canada), Mirror (New Hampshire), Lawrence (Michigan), and Wingra (Wisconsin). In well-oxygenated lakes RQ is near unity and anaerobic respiration is tightly coupled to aerobic. Lakes not well oxygenated have RQs significantly < 1, and important amounts of potential energy are diverted from biota through alternate electron acceptors (anaerobic microbial respiration) and have a direct thermodynamic impact on lake inorganic chemistry (benthic detrital electron flux). RQs significantly < 1 indicate the lake is returning energy to the biota as the oxidation of reduced products is assisted by lithography and primitive photosynthesis. Despite contrary trophic level indicators, both Mirror and Findley Lakes experienced brief periods of intense metabolism which placed critical demands on total aphotic zone capacity to accept electrons. In eutrophic Wingra and Lawrence.

RQs indicate more chronic electron accepter limitation. The phenomenon of excess CO2 production suggests the ideal RQ of 0.85 is not likely among prokaryotes where terminal oxygen reduction is not closely linked to carbon oxidation. (Lynch-Wisconsin)
W79-08918

ANALYSIS OF FIVE NORTH AMERICAN LAKE ECOSYSTEMS. VIII. CONTROL MECHANISMS AND REGULATION,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
R. G. Wetzel, and Richey.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 605-608. 1 tab, 9 ref.

Descriptors: *Lakes, *Respiration, *Organic matter, *Flushing rate, *Primary productivity, *Degradation(Decomposition), *Carbon cycle, Metabolism, Findley Lake(Washington), Marion Lake(B.C.-Canada), Mirror Lake(New Hampshire), Lawrence Lake(Michigan), Lake Wingra(Wisconsin), Carbon, Catabolism, Thermodynamics, Stratification, Littoral, Macrophytes, Algae, Phytoplankton, Regulation, Sediments, Sedimentation, Nutrient budgets, Succession, Baseline studies, Ecosystems, Food habits.

Input, degradation, and output functions were compared in five temperate-zone North American lakes, Findley (Washington), Marion (British Columbia, Canada), Mirror (New Hampshire), Lawrence (Michigan), and Wingra (Wisconsin). Several consistencies emerged from the eight-part study: (1) Very high renewal rates (flushing rates) resulted in loading (little organic) remaining in the basin long enough for effective degradation, and loss by outflow occurred regardless of the optimality of substrates or environmental conditions for decomposition. (2) Lack of stratification (low thermal stability) coupled with low renewal rates led to reduction of anaerobic conditions (due to constant resuspension) and maximum organic degradation. (3) Shifts to increasing autochthonous productivity by littoral flora in dimictic lakes resulted in progressively greater respiratory decomposition in sediments. (4) In lakes of moderate depth, phytoplanktonic decomposition occurred largely in the water column, shifting increasingly to sediments with decreasing mean depth. (5) Increasing dominance of organic matter loading by emergent littoral macrophytes led to greater inputs of refractory organic compounds, and greater anaerobic decomposition in sediments, higher respiratory quotients, and accelerated sedimentation. (6) Increasing productivity and accumulated organic matter shifted consumer dominance from allochthonous detritivores to zooplankton and autochthonous detritivores. (Lynch-Wisconsin)
W79-08919

PHYSIOGRAPHY OF LAKE LINNEVATN, WESTERN SPITSBERGEN,
Oslo Univ., Norway. Dept. of Limnology.
A. Boyum, and J. Kjensmo.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 609-614. 2 fig, 3 tab, 6 ref.

Descriptors: *Lake Linnevatn(Norway), *Physiography, *Hydrography, *Heat budget, *Ice cover, *Sulfates, *Glacial lakes, *Polar regions, Lakes, Norway, Spitsbergen(Norway), Meteorology, Water temperatures, Ions, Melt water, Geology, Gypsum, Conductivity, Magnesium, Calcium.

The meteorology, hydrography, and ionic composition of the water of Lake Linnevatn, a glacial lake in western Spitsbergen, Norway, are described, based on 1968 data. Lake Linnevatn behaves thermally like a true polar lake because: (1) high amounts of heat are required to melt the relatively thick ice cover and overlying snow, and the lake is sheltered from the most-intense solar radiation; and (2) the lake continuously receives considerable quantities of cold glacial melt water during thaw, which greatly reduces heat storage. Maximum water temperature was three C on 27 August. The ice cover disappeared on 13 August, abnormally late due to significantly lower-than-average mean water temperatures throughout the year. Vertical water temperature series taken on 17, 20, and 27 August showed lake heat contents of 2404, 2200, and 1864 cal/sq cm, based on four C. Heat income for the period accordingly was 540 cal/sq cm. The lake can be characterized as typically sulfated; sulfates constitute about 60% of total milliequivalents of anions in the water. Calcium is the dominant cation, and magnesium content is high. These three components are derived from rocks in the lake's catchment, specifically gypsum. Lake water is fairly rich in soluted salts. Specific conductivity averaged 181 x 18-units, but was relatively poor in electrolytes compared with Lake Kongressvatn, which averaged 512 x 18 units. (Lynch-Wisconsin)
W79-08920

LAKES OF POLAR REGIONS--AGE, COMPLEXITY, AND TROPHIC STATE,
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
C. Holmquist.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978. Part 1, p 615-617, 16 ref.

Descriptors: *Polar regions, *Lakes, *Trophic level, *Age, *Alaska, *Arctic, *Classification, Polar lakes, Greenland, Glacial lakes, Siberia(U.S.S.R.), Lake Hazen(Canada), Nettilling Lake(Canada), Lake Peter(AK), Lake Schrader(AK), Benthic fauna, Lake Imikpuk(AK), Plankton, Canada, Lake Linnevatn(Norway), Lake Kongressvatn(Norway), Norway, Cold regions.

An assumption that arctic lakes are young, poor in nutrients and therefore oligotrophic, and biologically simple is not accurate for all such lakes, or even for the average arctic lake. Few world lakes fit the definition of 'polar lakes' (having water temperatures never exceeding 4 C); Lake Hazen of Ellesmere Island, Canada, may be one example, and Lakes Linnevatn and Kongressvatn of Spitsbergen, Norway, are borderline. Polar lakes hardly exist in Alaska and are scarce in Greenland and Siberia. Only a few deep lakes from formerly glaciated areas have been used to support the simplistic definition, including Lake Hazen, Nettilling Lake, and other Canadian lakes, and Lakes Peter and Schrader of Alaska's eastern Brooks Range. Lake Imikpuk (Barrow, Alaska) has also been cited, but it is hardly typical as it is located on the sandy shore of the ocean, and has been flooded at least once by ocean water and then subjected to man-controlled freshening. Alaskan lakes often reveal not only considerable diversity and richness of benthic invertebrates, but often also a lack of consistency between water quality, plankton, and benthic fauna. This suggests a need for caution in classifying a lake's trophic status on the basis of physico-chemical and planktonic properties. Though lakes from glaciated areas are no older than the retreat of the ice, in unglaciated regions lakes may be much older. (Lynch-Wisconsin)
W79-08921

CORRELATION BETWEEN EXCHANGEABLE PHOSPHORUS AND SEDIMENTARY PIGMENT IN SOME IRISH LAKES,
Dundalk Regional Technical College, County Louth (Ireland). Science Dept.
D. J. Douglas, D. A. Murray, M. Halliday, and J. Greene.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 618-623. 2 fig, 2 tab, 15 ref.

Descriptors: *Ireland, *Lakes, *Pigments, *Phosphorus, *Bioavailability, *Sediments, *Eutrophication, *Trophic level, Lough Ennell(Ireland), Lough Gowna(Ireland), Lough Muckno(Ireland), Lough Ramor(Ireland), Lough Key(Ireland), Iron, Cores, Chlorophyll, Carotenoids, Primary productivity, Nutrients, Exchangeable phosphorus, Algae, Phytoplankton, Mud.

Pigment levels and the exchangeable phosphorus fraction in one-m sediment cores generally correlated well in a study of five eutrophic lakes in the Irish midlands, except in shallow Lough Ramor where submerged aquatic vegetation appears to remove large quantities of phosphorus from sediments, and in Lough Key and the north basin of Lough Gowna where significant iron levels may cause rapid phosphorus precipitation. In addition, Gowna's north basin has low levels of primary production and phosphorus. In Loughs Ennell, Gowna (south basin), and Muckno, all subject to artificial enrichment and showing increases in eutrophication, there was remarkable similarity between exchangeable phosphorus levels and pigment concentrations. The lakes in which this correlation was not evident showed little indication of increased eutrophication. Chlorophyll derivatives and total carotenoids were taken to reflect changing production, with low ratios between the two indicating eutrophic conditions with allochthonous production prevailing, and high ratios indicating greater proportional inputs of allochthonous material. Loughs Ennell and Muckno are highly eutrophic, Lough Key eutrophic, Lough Ramor enriched, and Lough Gowna tends toward eutrophic conditions, especially in the south basin. Exchangeable phosphorus appears to approximate the fraction of phosphorus available to algae at the time of sediment deposition. (Lynch-Wisconsin)
W79-08922

BIOSTRATIGRAPHICAL EVIDENCE FOR VARIATIONS IN THE RECENT PATTERN OF SEDIMENT ACCUMULATION IN LOUGH NEAGH, N. IRELAND,
University Coll., London (England).
R. W. Battarbee.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 624-629. 4 fig, 9 ref.

Descriptors: *Lough Neagh(N. Ireland), *Biostratigraphy, *Bottom sediments, *Palynology, *Paleolimnology, *Deposition(Sediments), Micropaleontology, Sediments, Cores, Diatoms, Algae, Resuspension, Stratigraphy, Northern Ireland, Lakes, Lake morphology, Sedimentation rates.

Strong differences in accumulation rates both among cores at the same sampling location and within cores in flat-bottomed Lough Neagh, Northern Ireland, indicate that in the absence of sediment surface micro- and macromorphometry it is impossible to locate sites with a predictable history of accumulation or stratigraphy within the lake's profundal zone. Moreover, since there are no clearly defined lithostratigraphic changes in the upper three meters it is impossible to recognize a particular core type in the field. A core's stratigraphic record can only be assessed through independent dating of each core or microfossil analysis and correlation with dated cores. If sediment is constantly being redistributed, causing areas of high and low accumulation rates, net sediment losses may occur, and apparently slow accumulation in a given core may be as much a result of intermittent accumulation phases as of slow but continuous accumulation. An inverse relationship between microfossil concentration (e.g., diatoms) and sediment accumulation rate cannot be assumed, because of the possibility of sediment redistribution rather than influx of allochthonous matter. Cores were taken 1969-1973 in the Battery area, Antrim Bay, and the Trench. Undetected variations in sediment surface features may affect the accumulation rates. Cores with intermediate accumulation rates were scarce or absent. (Lynch-Wisconsin)
W79-08923

CARBOHYDRATE CONTENT AS AN ECOLOGICAL TOOL IN THE STUDY OF PLANKTONIC BLUE-GREEN ALGAE,

Ministry of Agriculture, Antrim (Northern Ireland). Freshwater Biological Investigation Unit.
C. E. Gibson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978. Part 1, p 630-635, 3 fig, 1 tab, 8 ref.

Descriptors: *Cyanophyta, *Carbohydrates, *Analytical techniques, *Phytoplankton, *Limiting factors, *Lough Neagh(Northern Ireland), Algae, Lakes, Northern Ireland, Oscillatoria agardhii, Stephanodiscus astraea, Melosira italica subarctica, Diatoms, Chrysophyta, Chlorophyll, Pseudoanabaena, Water temperature, Bioassay, Methodology, Ecology, Nutrients, Nitrogen, Phosphorus, Darkness, Respiration.

The use of anthrone-reactive carbohydrate content of planktonic cyanophytes in studying the previous light history of lake planktonic algae (and their movement through the water column), cell nutrition, and dark respiration rate is illustrated with field and laboratory data for Lough Neagh, Northern Ireland, January-June 1977. Carbohydrate content of blue-green algae rises in response to light incubation and nutrient deficiency, and falls in darkness. With nutrient sufficiency carbohydrate content and dark respiration rate show close positive correlation. Striking resemblance was found between water temperature and carbohydrate profiles 1-2 June in Antrim Bay, when a temperature gradient was changed by winds which stirred warm water downward. Since cell carbohydrate content is predictable, a cell must be able to control it. A natural phytoplankton population of the dominant diatoms Stephanodiscus astraea and Melosira italica subarctica, and the cyanophyte Oscillatoria agardhii was incubated in light at eight C for 25 hrs; carbohydrate content rose rapidly during the first five hours, then slowed to an equilibrium level of 48-50 mg carb/mg chl-a. Darkness produced the reverse effect. Nitrogen or phosphorus starvation produces higher carbohydrate levels which do not decline rapidly until the deficient nutrient is added. This effect could be used in a rapid assay of nitrogen or phosphorus deficiency. Some carbohydrate loss in the dark is due to transformation to protein, but much is respired causing considerable changes in cell dry weight. (Lynch-Wisconsin)
W79-08924

RESPONSE OF SOME BRITISH LAKES TO PAST CHANGES IN LAND USE ON THEIR CATCHMENTS,
Freshwater Biological Association, Cumbria (England).
W. Pennington.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 636-641, 2 fig, 2 tab, 9 ref.

Descriptors: *Lakes, *United Kingdom, *Organic matter, *Land use, *Deposition(Sediments), *Paleolimnology, Deforestation, Seston, Sediments, Sedimentation rates, Carbon, Nitrogen, Phosphorus, Potassium, Nutrients, History, Palynology, Urbanization, Agriculture, Hubbard Brook(UK), Loch Clair(Scotland), Ennerdale Water(England), Blelham Tarn(England), Radioactive dating, Eutrophication.

Present annual sediment deposition rates for 13 British lakes are compared with historical evidence based on palynology and radioactive dating. Inputs of carbon, nitrogen, phosphorus, and potassium were calculated from the position of the 1963 horizon, determined by distribution curves for fallout of cesium-137. Analysis per unit wet volume of 1963 and overlying sediments in contiguous one-cm slices provided an estimate of mean annual deposition over unit area, which differed between lakes as much as 20-fold, greatly exceeding between-lake differences for any element relative to either dry weight or wet volume. Highest sediment accumulation rates were found in lakes with the highest nitrogen and phosphorus levels in surface sediments, highest population density, and summer hypolimnion oxygen deficiency. Between-lake differences appear to be of recent origin and related to enrichment, based on comparative data for the last 150 years derived from lead-210 dating. Evaluations are also presented for the entire postglacial period. Loch Clair, an acid, unproductive lake in northwest Scotland, is in a nearly natural state with an undisturbed forest catchment. A historical organic matter deposition rate of 5-6 mg/sq cm compares with a present rate of 2-3 mg C/sq m. Unproductive Ennerdale Water (English Lake District) shows pollen evidence of major deforestation and cultivation around 1000 B.P. Blelham Tarn, a shallow, productive lake in the Lake District, shows increased sediment accumulation and eutrophication with deforestation also at about 1000 B.P. (Lynch-Wisconsin)
W79-08925

BIOLOGICAL AND CHEMICAL STUDIES OF SEDIMENTS FROM LLANGORSE LAKE, WALES,
Trent Univ., Peterborough (Ontario).
R. Jones, K. Benson-Evans, F. M. Chambers, B. A. Seddon, and Y. C. Tai.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 642-648, 6 fig, 17 ref.

Descriptors: *Llangorse Lake(Wales), *Palynology, *Sediments, *Eutrophication, *History, *Paleolimnology, *Agricultural runoff, Organic matter, Wales, Lakes, Chemical analysis, Phytoplankton, Diatoms, Chrysophyta, Algae, Anabaena flos-aquae, Cyanophyta, Stratigraphy, Cores, Radioactive dating, Carbon radioisotopes, Agriculture, Deforestation, Water pollution sources.

Palynology, diatom identification, and chemical analysis of sediments were used to study the history of shallow Llangorse Lake, the largest body of freshwater in southern Wales and subject to algal blooms over recent centuries. The study focused on a transition zone at 280-272 cm in a core from one basin (core 1) and at 244-240 cm in a core from the other basin (core 2), radiocarbon dated at 1790 + or - 60 yrs B.P. The stratigraphy showed a dramatic change from a lower black organic nekton mud to an upper inorganic red-brown silty clay. The date indicates the change occurred after the Roman defeat of the Silurians in A.D. 74-78. Following the campaign crop production was expanded around the lake, possibly to support local Roman garrisons. Sediments in the transition zone show declining tree pollen and increased grass, cereal, and weed pollen, accompanied by substantial soil erosion as indicated by the shift from organic to inorganic sediments. Apparently due to increased turbidity, epiphytic diatoms declined in transition zone sediments in core 1 as they were eliminated from macrophytes. Their continued absence above the zone suggests persistent turbidity. There was a pronounced increase in specific gravity and a corresponding decline in water content in the zone in core 1, and in both cores organic matter and Kjeldahl nitrogen decreased with increasing inorganic content. Iron, aluminum, magnesium, and potassium rose, but calcium did not until 150-100 cm. (Lynch-Wisconsin)
W79-08926

ECOSYSTEM EXPERIMENTATION IN THE MANAGEMENT OF A SYSTEM OF SHALLOW LAKES,
University of East Anglia, Norwich (England). School of Environmental Sciences.
B. Moss, R. T. Leah, and D. E. Forrest.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 649-653, 1 fig, 12 ref.

Descriptors: *Water management(Applied), *Macrophytes, *Eutrophication, *Gulls, *Water pollution sources, *Hickling Broad(England), Lakes, Norfolk Broads(England), England, Ecosystems, Shallow water, Phytoplankton, Algae, Diatoms, Chrysophyta, Cyanophyta, Nutrients, Phosphorus, Sewage disposal, Experimental ecosystems, Vollenweider models, Larus ridibundus, Najas marina, Potamogeton, Water pollution effects, Guano, Succession, Sediments, Peat.

Droppings from black-headed gulls (Larus ridibundus) are primarily responsible for eutrophication in shallow Hickling Broad (Norfolk Broads, England) and decline of the famed submerged macrophyte swards. Experiments with Lund Tubes (20-m diameter open enclosures embedded in sediments and extending to the surface) demonstrated that boat disturbances and mud texture are of secondary importance in the decline of the macrophytes. Gull guano did contaminate the tubes, however, focusing attention on eutrophication and nutrient sources. The birds are present October-January in flocks of 100,000-250,000, daily excreting about 38 mg P per bird. Their droppings contain both readily soluble and combined phosphorus and nitrogen. Some soluble nutrient is rapidly leached out but much falls to the sediments, the major nutrient source during the summer cyanophyte bloom. Immediately available phosphorus and ammonia plus nitrate and ammonium from the agricultural catchment support large populations of the diatoms Synedra sp. and Diatoma elongatum (over 190,000/ml, 200 microg chl-a/l), which decline in March due to deficiencies of soluble phosphorus, nitrogen, and silicon. Phytoplankton increase again in May, peaking in August with cyanophytes dominating. Nutrients are sufficient to maintain the bloom until concentrations are diluted by autumn flushing. Macrophytes in the lake had included the rare Najas marina, various charophytes, and Potamogeton spp. (Lynch-Wisconsin)
W79-08927

EVIDENCE FOR NUTRIENT RELEASE FROM THE SEDIMENTS OF TWO SHALLOW AND PRODUCTIVE LAKES,
University of East Anglia, Norwich (England). School of Environmental Sciences.
P. L. Osborne, and G. L. Phillips.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 654-658, 4 fig, 17 ref.

Descriptors: *Barton Broad(England), *Alderfen Broad(England), *Sediments, *Nutrients, *Water pollution sources, *Macrophytes, Phytoplankton, Algae, Norfolk Broads(England), Peat, Lakes, England, Phosphorus, Nitrogen, Silicon, Oxidation-reduction potential, Lake restoration, Bioavailability, Organic matter, Sewage disposal, Agricultural runoff, Shallow water, Nutrient loading.

Nutrient release from sediments in shallow, eutrophic Alderfen and Barton Broads (Norfolk, Broads, England), accounts for summer increases of phosphorus, ammonium-nitrogen, and soluble reactive silicon. Such release is indicated both by timing of nutrient increases and by presence of anaerobic conditions at the sediment surface around sunrise in summer, when water temperature is high and bacterial activity greatest. Such conditions would favor phosphorus release provided labile phosphorus-rich organic matter were present. Aderfen Broad receives its phosphorus supply from agricultural drainage, and Barton Broad receives 80% from sewage effluent carried by the River Ant. Algal growth in spring, dependent on external nutrient loading, probably has prevented recolonization of submerged macrophytes lost in the 1960s. Nutrient loading reduction should enable the plants to recolonize, and much of the summer release of nutrients from sediments could be taken up by the macrophytes, thus preventing summer algal growth. Phosphorus removal by phosphate-stripping of sewage effluent discharged to the Ant should effectively reduce phytoplankton in Barton Broad, though significant release of nutrients from sediments could continue for several years. At Alderfen Broad, which has no outflow of water in summer, phosphorus loading reduction would not lead to net export of phosphorus and recovery might not occur. The broads were formed in the late 13th century from flooded peat diggings. (Lynch-Wisconsin)
W79-08928

GROWTH AND PRODUCTION OF ISOETIDS IN OLIGOTROPHIC LAKE KALGAARD, DENMARK,
Copenhagen Univ., Hillerod (Denmark). Freshwater Biological Lab.
K. Sand-Jenson, and M. Sondergaard.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 659-666, 5 fig, 3 tab, 18 ref.

Descriptors: *Lake Kalgaard(Denmark), *Isoetids, *Littorella uniflora, *Lobelia dortmanna, *Leaves, *Plant growth, Macrophytes, Denmark, Lakes, Oligotrophy, Primary productivity, Leaf turnover rate, Biomass, Roots, Seasonal.

Leaf turnover rates of the isoetids Littorella uniflora and Lobelia dortmanna in oligotrophic Lake Kalgaard, Denmark, and unimodally seasonal with maxima in June (0.83%/day) and July (0.56%/day). Renewal of leaf biomass is 150%/yr for Littorella and 80% for Lobelia. Lobelia root turnover rate is equal to that of the leaves, probably true also for Littorella. Leaf growth was determined 1975-76 by marking the youngest leaf of 30-60 shoots with a nontoxic speed-marker (Penol 700) and checking growth after 1-2 months in summer and 5-7 months in winter. Turnover rate equals the number of leaves produced in proportion to total number present. Carbon-14 experiments with Littorella corresponded well to the leaf-marking tests. In July-August its photosynthesis is light-saturated most of the day, and short-term assimilation under ambient carbon dioxide concentrations is limited by carbon supply. About 95% of carbon-14 CO2 assimilated is taken up by roots, invalidating earlier isoetid production experiments in which carbon-14 CO2 were added only to leaves. Isoetids of rosette growth form dominate the macrophytes of Lake Kalgaard, occupying about 40% of the lake bottom. Net production on various sediment types is 124-383 g/sq m/yr (organic dry wt) for Littorella and 1.5-3.8 g for Lobelia, whose low production is due to low biomass. (Lynch-Wisconsin)
W79-08929

TOTAL AUTOTROPHIC PRODUCTION IN OLIGOTROPHIC LAKE KALGAARD, DENMARK,
Aarhus Univ. (Denmark). Botanical Inst.
M. Sondergaard, and K. Sand-Jenson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 667-673, 2 fig, 2 tab, 21 ref.

Descriptors: *Lake Kalgaard(Denmark), *Primary productivity, *Autotrophy, *Epiphytes, *Macrophytes, Phytoplankton, Chlorophyta, Denmark, Lakes, Algae, Bulbochaete, Mougeotia, Oedogonium, Spirogyra, Zygnema, Carbon radioisotopes, Littorella uniflora, Isoetes lacustris, Lobelia dortmanna, Oligotrophy.

Epiphyte, macrophyte, and total autotrophic production are presented for oligotrophic Lake Kalgaard, Denmark. Further data on physico-chemical conditions, phytoplankton production, and macrophyte distribution and production are published elsewhere. In Lake Kalgaard phytoplankton and submerged macrophyte production are equal, and production by littoral algal epiphytes is unimportant. The epiphytes cannot compete with either the phytoplankton, which obtain carbon dioxide and nutrients from the limnetic zone, or the macrophytes, which rely on sediments for carbon dioxide and nutrients. Low dissolved inorganic content of carbon, nitrogen, and especially phosphorus probably limits the quantitative importance of the epiphytes. Microbenthic algae are insignificant since the entire littoral is densely covered with the macrophytes Littorella uniflora, Isoetes lacustris, and Lobella dortmanna. Epiphytes are present only in the L. uniflora zone (0-2 m), dominated by species of the chlorophytes Bulbochaete, Mougeotia, Oedogonium, Spirogyra, and Zygnema. Epiphyte production, though greatly variable among parallel samples, is very low (less than 50 mg C/sq m lake bottom/day). Production is similar on sand and on an organic substrate due to higher leaf biomass. Seasonal variation is greater on the sand substrate. Total autotrophic production is lower than phytoplankton production of eutrophic lakes. (Lynch-Wisconsin)
W79-08930

QUANTITATIVE AND QUALITATIVE DETERMINATIONS OF CHLOROPHYLLS AND PHAEOPIGMENTS IN LAKE MOSSO,
Aarhus Univ. (Denmark). Botanical Inst.
B. Riemann.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 674-677, 2 fig, 23 ref.

Descriptors: *Lake Mosso(Denmark), *Eutrophication, *Chlorophyll, *Phaeopigments, *Chromatography, *Spectrophotometry, Methodology, Analytical techniques, Phytoplankton, Zooplankton, Algae, Pigments, Lakes, Denmark, Measurement, Phaeophorbide, Phaeophytin, Nutrients, Ecology, Biomass.

Quantitative spectrophotometric and chromatographic methods were used comparatively to determine relative chlorophyll-a and phaeopigment-a levels in Lake Mosso, Denmark, 1974-76 to evaluate ecological significance of naturally occurring phaeopigments in a eutrophic lake. Results show that estimates of phytoplankton biomass from chlorophyll must be corrected for the occurrence of phaeopigments. Phaeopigment-a in Lake Mosso is quantitatively close to that reported for the sea (23-86% chl-a) and from lakes (16-56%). Chlorophyll-a ranges from four mu-l in February 1975 to 1952 mu-l in August 1975. Phaeopigment-a is always present, varying from two mu-l in March 1976 to 56 mu-l in March 1974. Phaeopigment-a percentage relative to chlorophyll-a varies from 1.8% in March 1976 to 56.2% in April 1975. Chromatography recorded somewhat lower percentages than spectrophotometry (correlation r=0.98). Maximum occurrences of phaeopigment-a coincides with decreases in chlorophyll-a except on one occasion. Phaeophorbide-a is the main degradation product, whereas phaeophytin-a has only been recorded during a period of heavy zooplankton grazing. In June 1975 an enormous quantity of zooplankton (Cyclops, Daphnia) cleared the waters, then disappeared a week later. Only 38% chlorophyll-a was found chromatographically and phaeopigments consisted mainly of phaeophytin-a, which also disappeared after a week. Zooplankton are of minor importance in controlling phytoplankton during most of the year compared with nutrient depletion. (Lynch-Wisconsin)
W79-08931

RELATIONSHIP BETWEEN PHYTOPLANKTON PHOTOSYNTHESIS AND LIGHT, TEMPERATURE AND NUTRIENTS IN SHALLOW LAKES,
Odense Univ. (Denmark). Biological Inst.
E. Lastein, and E. Gargas.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 678-689, 8 fig, 5 tab, 38 ref.

Descriptors: *Lakes, *Phytoplankton, *Photosynthesis, *Primary productivity, *Light, *Water temperature, *Analytical techniques, Denmark, Shallow water, Chlorophyll, Nutrients, Model studies, Mathematical models, Equations, Respiration, Darkness, Seasonal.

For 18 shallow Danish lakes, results are reported of studies of effects of light, temperature and nutrients on three parameters: (1) light-saturated photosynthesis/unit chlorophyll-a (PBm); (2) photosynthesis/unit chlorophyll-a at low light levels, corresponding to dark respiration (PB); and the irradiance at which the initial and horizontal parts of the light-photosynthesis curve intersect (I sub K). Variations in the parameters correlated with irradiance, temperature, and nutrients in very complex ways; this indicates that predictions of daily phytoplankton production based only on measurements of the state variables chlorophyll-a and nutrients, and on the forcing functions light and temperature, give only a rough estimate of the real values. PB showed only slight variations during the collection period (February-November 1974), with average range of 0.9-1.4 mg C/mg chl-a. PBm showed strong variation, ranging from 2.7 to 5.2 mg C/mg chl-a/two hrs. I sub K varied seasonally from 4.0 to 8.2 cal/sq m/min. Highest PBm and I sub K values were found in the most eutrophic lakes and the lowest in the most oligotrophic, consistent with other studies. A possible explanation is that phytoplankton in oligotrophic waters are often smaller than in eutrophic waters, and the half-saturation constant for nutrient uptake in large cells is higher than for nonnoplankton. Contrary to results for grouped data, for all data PB correlated strongly with PBm, showing temperature has a greater influence on photosynthetic parameters than light. (Lynch-Wisconsin)
W79-08932

CYANOPHYCEAE AND ENVIRONMENTAL FACTORS IN 15 DANISH LAKES,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
K. Olrik.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 690-695, 2 fig, 4 tab, 5 ref.

Descriptors: *Denmark, *Cyanophyta, *Eutrophication, *Lakes, *Microcystis aeruginosa, *Nutrients, Phosphorus, Nitrogen, Depth, Algae, Phytoplankton, Organic matter, Luxury absorption, Ecology, Chemical properties, Magnesium, Zinc, Copper, Succession.

Blue-green algal maxima were studied in relation to mean concentrations of nutrients and microelements in 15 Danish lakes in order to clarify phytoplankton succession in increasingly eutrophic lakes. Positive correlations were found between cyanophycean and Microcystis aeruginosa maxima and mean values of total phosphorus (correlation coefficients of 0.65 and 0.66), total nitrogen (0.50, 0.67), inorganic nitrogen (0.63, 0.34), zinc (0.78, 0.81), copper (0.70, 0.78), and magnesium (0.63, 0.68). Cyanophycean maxima plotted against lake mean depth yielded a hyperbolic co-variation if lakes richest and poorest in phosphorus were excluded, indicating co-variation of cyanophycean maxima with mean depth and mean total phosphorus. The relationship of cyanophycean maxima to mean total nitrogen level was linear if lakes with lowest mean concentration of total phosphorus were excluded, indicating co-variation of cyanophycean maxima with mean total nitrogen and mean total phosphorus. Large cyanophycean maxima were found at mean depths of three m or less, and at mean total phosphorus concentrations above 0.25 mg/l. These conditions can be expressed as a rising hyperbola with decreasing depth and increasing mean total phosphorus level. A combination of high mean total phosphorus and nitrogen concentrations tended to be followed by a large cyanophycean maximum. The largest blue-green maxima were found in lakes with a combination of high mean total phosphorus and nitrogen levels, and a mean depth less than or equal to three m. (Lynch-Wisconsin)
W79-08933

NITROGEN AND PHOSPHORUS DYNAMICS IN EUTROPHIC FREDERIKSBORG SLOTSSO,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
O. S. Jacobsen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmarlk, 8 August 1977. Vol. 20, September 1978. Part 1, p 696-701, 3 fig, 21 ref.

Descriptors: *Frederiksborg Slotsso(Denmark), *Eutrophication, *Nitrogen, *Phosphorus, *Cycling nutrients, *Mineralization, Nutrients, Bacteria, Sediments, Zooplankton, Sedimentation rate,

Primary productivity, Lakes, Denmark, Summer, Degradation(Decomposition), Epilimnion, Hypolimnion, Phytoplankton, Algae.

Nitrogen and phosphorus regenerative velocity was investigated in Frederiksborg Slotsso, Denmark, and the influence of bacterial, zooplanktonic, and sedimentary mineralization was evaluated in this eutrophic lake. Results confirm that rapid recycling occurs during summer in eutrophic as well as in oligotrophic lakes, but in Frederiksborg Slotsso bacterial decomposition (60-80% of total regeneration) was more important than zooplanktonic regeneration (3-7%), contrary to the situation in oligotrophic lakes. In addition, phosphate and inorganic nitrogen recycling times were of the same order of magnitude during the entire growing season, (April-September). During the growing season 85% of total mineralization occurred in the eplimnion and 15% in the hypolimnion and sediment. Zooplankton mineralization was almost negligible compared to net phytoplankton uptake. Frederiksborg Slotsso is located in North Zealand, and has an area of 20.9 ha and a mean depth of 3.1 m. Annual gross primary production is 560 g C/sq m (phytoplankton only). Physical and chemical data were gathered semimonthly September 1975-November 1976. Increased inorganic phosphorus and nitrogen levels promoted production of algal phosphorus and nitrogen, followed by decomposition of algae by zooplankton and bacteria and an increased sedimentation rate, leading to increased nutrient release from sediments. (Lynch-Wisconsin)
W79-08934

PLANKTON PRIMARY PRODUCTION AND RESPIRATION IN EUTROPHIC FREDERIKSBORG SLOTSSO, DENMARK,
Copenhagen Univ., Hillerod (Denmark). Freshwater Biological Lab.
J. M. Andersen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 702-708, 5 fig, 2 tab, 11 ref.

Descriptors: *Frederiksborg Slotsso(Denmark), *Primary productivity, *Respiration, *Phytoplankton, *Bacteria, *Eutrophication, Zooplankton, Algae, Denmark, Lakes, Food chains, Ecosystems, Ecology, Organic matter, Gross primary production, Net primary productions, Carbon radioisotopes, Chlorophyll, Light-dark bottle method, Testing procedures, Methodology.

Measurement of both gross primary production (GPP) of autotrophs and net primary production (NPP) (which considers production and organic matter cycling) is necessary for describing food chain relationships in aquatic ecosystems. NPP, essential for determining the amount of organic matter potentially available to consumers, is very difficult to measure since it is usually impossible to determine bacterial respiration separately. In consequence NPP estimates within 50% of real values are probably nonexistent. In this study phytoplankton NPP minus bacterial respiration was measured with the oxygen light and dark bottle technique with corrections for zooplankton respiration, using data from Frederiksborg Slotsso, a small eutrophic lake in Zealand, Denmark, with an area of 21 ha and a mean depth of three m. The ecological significance of the NPP thus measured is that it roughly corresponds to the amount of organic matter available to links in the food chain following algae and bacteria. Algal NPP is about half that of GPP in the lake, probably not an uncommon situation. NPP may constitute a variable fraction of GPP, and the practice of calculating NPP as 7-80% of GPP is therefore inaccurate and misleading. Zooplankton respiration amounts to about 13% of GPP, though accuracy may be low since the value was calculated indirectly from zooplankton weight. Some data suggest that algae are the main contributors to algal and bacterial respiration, with bacteria playing a minor role. (Lynch-Wisconsin)
W79-08935

TOXICITY OF A PHOSPHATE-REDUCING AGENT (ALUMINUM SULPHATE) ON THE ZOOPLANKTON IN THE LAKE LYNGBY SO,
Copenhagen Univ. (Denmark). Inst. of Comparative Anatomy.
T. Sonnichsen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 709-713. 4 fig, 11 ref.

Descriptors: *Lyngby So(Denmark), *Toxicity, *Aluminum sulfate, *Phosphates, *Lake restoration, *Zooplankton, *Eutrophication, *Alum, Denmark, Lakes, Aluminum, Sediments, Nutrients, Flocculation, Cladocera, Copepods, Cyclops strenuus, Chydorus sphaericus, Bosmina longirostris, Ecology, Suspended solids, Lethal limit, Metabolism, Flushing rate, Hydrogen ion concentration, Environmental effects, Phytoplankton, Algae, Ecosystems.

Application of aluminum sulfate to limit sediment phosphate release in Lyngby So, a eutrophic Danish lake of one million cu m, drastically reduced zooplankton density to about 20 ind/l shortly after application. Cladocerans dropped from 45% of zooplankton to 20% 15 days after treatment. Beginning May 1974, 126 tons of aluminum sulfate were added over a two-month period. Treatment had only a transitory effect on phosphate-phosphorus concentration. Though zooplankton subsequently increased to even higher values than prior to treatment, the reducing agent definitely was lethal to zooplankton, and continued addition of the agent might have reduced them even further, resulting in a phytoplankton bloom. The relatively low damage to the zooplankton probably was due to rapid water exchange in the lake (water is renewed nine times/yr) and because the normal pH of nine is unfavorable to the desired flocculation of aluminum phosphate complexes (the optimum pH is 4-7). Although this type of restoration is most suitable for lakes with slow water renewal rates, direct application of aluminum salts to freshwater systems should be avoided because: (1) the metal contamination has serious effects on fauna, and (2) most lakes in need of restoration have high pH. Dominant zooplankters in Lyngby So were Bosmina longirostris, Chydorus sphaericus, and Cyclops strenuus. (Lynch-Wisconsin)
W79-08936

INFLUENCE OF BATHYMETRY ON SEDIMENT FOCUSING IN LAKE ESROM,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
L. Kamp-Nielsen, and B. T. Hargrave.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 1, p 714-719. 1 fig, 2 tab, 15 ref.

Descriptors: *Lake Esrom(Denmark), *Bathymetry, *Sediment focusing, *Organic matter, *Nutrients, *Sediment transport, Denmark, Lakes, Sediments, Sedimentation, Phosphorus, Carbon, Nitrogen, Depth, Cores, Mixing.

Increasing concentrations of sediment organic matter, total phosphorus, organic carbon, and nitrogen with depth in evenly spaced sediment cores taken 28-30 October 1974 from the central area of Lake Esrom, Denmark, indicate the occurrence of sediment focusing (enhanced sediment accumulation in the deeper parts of a basin). Areas of organic matter accumulation correspond to depressions in the lake's profundal zone. Accumulation of organic carbon, nitrogen, and phosphorus at the base of steep slopes at depths of 13-16 m could be caused by sediment slumping, turbidity flows, or gradual erosion through current-induced water movement. Increased sedimentation has been observed during autumn overturn when mixing resuspends bottom sediments. This process undoubtedly transports much fine-grained sediment to the center of the lake, which, besides enhancing accumulation in deepest areas, also concentrates materials in specific areas. Spatial differences between patterns of concentrations for phosphorus, carbon, and nitrogen both horizontally and vertically in the sediment probably reflect degradation and exchange processes which remineralize phosphorus to a greater degree or more rapidly than carbon and nitrogen. Linear regression showed depth alone accounted for only a small fraction of the variance in measures of sediment organic and phosphorus content. Measures of organic matter, carbon, and nitrogen were significantly correlated, but not with total phosphorus. C:N ratios correlated poorly with other measures. (Lynch-Wisconsin)
W79-08937

MODELLING THE VERTICAL GRADIENTS IN SEDIMENTARY PHOSPHORUS FRACTIONS,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
L. Kamp-Nielsen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part I, p 720-727. 5 fig, 2 tab, 13 ref.

Descriptors: *Mathematical models, *Lake Esrom(Denmark), *Sediments, *Phosphorus, *Nutrient flux, *Mineralization, Equations, Model studies, Denmark, Lakes, Vertical distribution, Nutrients, Metabolism, Sedimentation, Oxygen, Phosphates, Diffusion, Sediment-water interfaces, Nutrient loading.

A dynamic multilayer sediment model incorporating most known processes to affect phosphorus migration in lake sediments is based on data for dimictic, mesotrophic Lake Esrom, Denmark. The model describes sediment-water exchange of nutrients when a change in loading occurs, and provides information about processes governing the exchange. The model consists of 60 layers in the active part of the sediments, 50 one-mm layers in the top five cm, and 10 five-mm layers in the 5-10 cm interval. In each layer mineralization of particulate organic phosphorus, sorption equilibrium between dissolved and absorbed phosphate, and diffusion along concentration gradients takes place. Systematic deviations between predicted and observed values makes the current model unsuitable for total lake modelling, but it can provide information for further sediment modelling. Deviations may be due to incorrect process descriptions or use of excessively stiff equations. Results indicate a substantial source of error was a too-rapid shift between layers due to use of too high a rate constant for early spring decomposition. Resulting low exchangeable phosphorus values persist throughout the sediment column because no positive contribution to this pool is described by the model. A mineralization constant changing with time or quality of sedimented material could correct this problem. Partition between various pools of sedimentary phosphorus based on chemical analysis may not accurately identify specific pools and processes. (Lynch-Wisconsin)
W79-08938

SEASONAL AND INTERSPECIFIC VARIATION IN CONSUMPTION OF EPHEMEROPTERA BY BROWN TROUT IN A SUBALPINE LAKE,
Oslo Univ. (Norway). Zoological Museum.
J. E. Brittain, and L. Lien.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 728-733. 2 fig, 2 tab, 12 ref.

Descriptors: *Brown trout, *Ephemeroptera, *Feeding rates, *Ovre Heimdalsvatn(Norway), *Food habits, *Seasonal, Salmo trutta, Lakes, Norway, Insects, Benthic fauna, Fish, Subalpine, Mountain lakes, Leptophlebia vespertina, Leptophlebia marginata, Faunal lists, Crustaceans.

Ephemeroptera, mostly mature numphs, constitute 3.7% (range 1.6-7.7%) of total annual caloric intake of brown trout, Salmo trutta, from Ovre Heimdalsvatn, a Norwegian lake, based on stomach contents examined 1969-72. Ephemeroptera,

found in 24.6% of 1588 trout specimens, are most abundant and constituted a higher proportion of caloric intake in June and July. Adults were rarely taken. Leptophlebia vespertina account for 68.3% of the Ephemeroptera consumed annually, and L. marginata 17.8%; other species are Baetis rhodani (4.4%), Siphlonurus lacustris (3.1%), and B. macani (1.3%). The relative importance of Ephemeroptera varies seasonally due principally to their life cycle and relative sizes. The lotic species B. rhodani and B. lapponicus are consumed mainly in spring. Such an apparently attractive species as S. lacustris having large size and relatively high density is underrepresented in trout stomachs. S. lacustris and S. aestivalis are eaten almost exclusively June-August, since at other times they are either in the egg stage or nymphs were too small. Maximum consumption of all species occurs immediately before or during their emergence period, when nymphs are largest, mostly day-active, and are migrating towards shore to emerge. The trout are usually captured with gill nets. Trout over 500 g consume somewhat fewer Ephemeroptera than did smaller fish, feeding to a greater extent on the crustaceans Gammarus lacustris and Lepidurus arcticus. (Lynch-Wisconsin)
W79-08939

EUTROPHICATION OF LAKE MJOSA IN RELATION TO THE POLLUTIONAL LOAD,
Norsk Inst. for Vannforskning, Blindern.
H. Holtan.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 734-742. 7 fig, 2 tab, 14 ref.

Descriptors: *Lake Mjosa(Norway), *Eutrophication, *Water pollution sources, *Water pollution effects, *Nutrient loading, *Limiting factors, Potable water, Municipal wastes, Norway, Lakes, Oscillatoria bornetti f tenuis, Cyanophyta, Odor-producing algae, Taste-producing algae, Succession, Nitrogen, Phosphorus, Nutrients, Hydraulic residence time, Fragilaria crotonensis, Diatoms, Urbanization, Fertilizers, Sediments, Seiches, Phytoplankton, Algae, Silicon, Light, Water temperature, Water supply.

Reduction of phosphorus loading to severely eutrophic Lake Mjosa, Norway's largest lake, seems the only practical means of preventing mass development of taste and odor-causing blue-green algae and reducing total algal production. Eutrophication is also dependent on several uncontrollable factors, including light, temperature and silicon content. Planned control measures include regulations limiting phosphorus inputs from agricultural fertilizers and industry, construction of phosphorus removal sewage treatment plants, and encouraging use of phosphate-free detergents. Lake Mjosa has a maximum depth of 449 m, mean depth of 153 m, surface area of 365 sq km, and theoretical retention time of six years. Signs of eutrophication first appeared in the early 1950s, and by the early 1960s algal biomass was increasing and phytoplankton composition changing. The nutrient-demanding diatom Fragilaria crotoensis appeared in great numbers. In recent years commonly occurring algal blooms were increasingly dominated by cyanophytes, especially Anabaena flos-aquae and Oscillatoria bornetii f. Tenuis. The latter was dominant 1975-76, constituting about 95% of algal biomass in fall 1976. Maximum algal production was about 2000 mg C/sq m/day. Annual production is relatively low (100 g C/sq m) due to the short production period (June-September). Basin population has grown from 116,000 in 1900 to 200,000 in 1975. Phosphorus loading is about one g/sq m lake surface/yr, and N about 15 g/sq m/yr. Odor and taste in drinking water are intensified with chlorination. (Lynch-Wisconsin)
W79-08940

BUFFERING OF ACID LAKES BY SEDIMENTS,
Oslo Univ. (Norway).
D. Hongve.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 1, p 743-748. 1 fig, 3 tab, 12 ref.

Descriptors: *Acidic water, *Neutralization, *Sediments, *Acid precipitation, *Svenskestutjern(Norway), *Vilbergtjern(Norway), Lakes, Norway, Air pollution effects, Water pollution sources, Hydrogen ion concentration, Cores, Chemical analysis, Ions, Sulfuric acid, Sulfates, Sulfur, Calcium, Absorption, Seepage, Flushing rate, Degradation(Decomposition), Ammonia, Ammonium, Buffers.

Sediments in Svenskestutjern and Vilbergtjern, two extremely dilute Norwegian seepage lakes with very low water renewal rates, are important buffers of acidity due to acid precipitation. Average pH is about 5.3-5.6, significantly less acid than precipitation. The neutralizing processes identified through laboratory tests with sediment cores are probably more important is this type of lake than in ordinary drainage lakes with short renewal times, where acidification problems are most severe. Sediment cores were exposed to extreme acidification in the laboratory; however, natural acidification is due in great part to sulfuric acid. Liberation of absorbed bases is probably less important in nature than in the tests. Calcium is the ion with the greatest absorbed concentration in the sediments. Sulfate reduction is important as indicated by a lower final sulfate concentration, and the fact that sulfate in the lake is lower than in precipitation. Since sulfate reduction is strictly an anaerobic process, it generally occurs only in sediments. Reduction of sulfate leads to a corresponding decrease in strong acid concentration. Under aerobic conditions sulfate absorption to the sediment surface is possible, likewise reducing acidity. Production of ammonia during organic matter decomposition also results in acid neutralization through formation of ammonium ions. Subsequent nitrification of the ammonium would have the opposite effect. (Lynch-Wisconsin)
W79-08941

RECENT SEDIMENTS IN A EUTROPHICATED LAKE: ARUNGEN, NORWAY,
Oslo Univ. (Norway). Dept. of Limnology.
O. K. Skogheim.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 749-757.

Descriptors: *Lake Arungen(Norway), *Sediments, *Eutrophication, *Nutrients, *Organic matter, *Spatial distribution, Lakes, Norway, Cores, Nutrient loading, Vertical distribution, Horizontal distribution, Depth, Lake restoration, Phosphorus, Carbon, Nitrogen, Ignition loss, Hydrogen ion concentration, Oxidation-reduction potential.

Accumulation and horizontal distribution of organic matter, nutrients, and other substances in sediments of eutrophic Lake Arungen, south of Oslo, Norway, were studied with 25-cm sediment cores taken in February 1977 at several locations and depths. Projected reduction in external loading to the lake may make sediments a significant source of internal loading. Allochthonous clay is the most important inorganic component of the sediments, while the organic component is mainly autochthonous clay originating mostly from plankton. Ignition loss (IL) and total carbon (TC) showed a highly significant statistical relationship (correlation coefficient 0.960). Highly significant correlation coefficients for total nitrogen (TN) vs IL (0.947) and TC (0.983) indicate sediment nitrogen is primarily in an organic form. Correlation coefficients for total phosphorus (TP) vs IL (0.782), TC (0.803), and TN (0.786) are significant at the 0.001 probability level. Correlation coefficients for water content vs organic matter are highly significant, reflecting water binding capacity of the organic matter. Both pH and Eh vary seasonally but do not correlate significantly with organic matter or phosphorus. Eh, pH, TC, TN, and TP are regularly distributed horizontally in surficical sediments, closely related to lake basin morphometry. All parameters show vertical variations within each core, dependent on lake depth. Organic matter and TP decrease sharply in profundal sediment cores from the surface to about 10 cm, below which the decrease is slower. (Lynch-Wisconsin)
W79-08942

CRYOCHEMISTRY OF LAKES WITH SPECIAL REFERENCE TO FORMATION, DISTRIBUTION, AND EFFECT OF PHOSPHORUS AND HYDRONIUM. A PRELIMINARY REPORT,
Norges Landbrukshoegskole, Vollebekk. Dept. of Agricultural Hydrotechnics.
O. Groterud.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 758-764, 1 fig, 5 tab, 13 ref.

Descriptors: *Hydronium, *Phosphorus, *Lakes, *Norway, *Ice-water interfaces, *Freezing, Acids, Acidic water, Ice cover, Snow, Phosphates, Cores, Ice, Reviews, Water pollution sources.

The cryochemistry of four meromictic and four holomictic lakes with low flow-through rates near Oslo, Norway was studied, emphasizing phosphorus, hydronium, and lake acidification. Ice cores, snow samples, and water samples were collected, and freezing and phosphate absorption experiments conducted. In the freezing experiments, different water samples of known composition were placed in 50-liter plastic containers and partially submerged in an ice-covered pond. Phosphate absorption tests were carried out by submerging ice sheets of distilled water in a 10-liter plastic container with a specific phosphate solution. In freezing tests, the ice thus formed was clear, with electrolytes and soluble organic matter completely frozen out, and phosphorus partially frozen out. Cryochemistry is of special importance for lakes with low-flow-through rates and with great volume of ice and snow relative to water, as in shallow lakes with small watersheds. The meromictic lakes studied circulate down to only a few meters in the spring thaw, and the icemelt is therefore an important determinant of phosphorus concentration in trophogenic layers. The four holomictic lakes were important for studying acidic ice and lake acidification. A review is given of the few previous papers on lake cryochemistry. Data are presented in five tables. (Lynch-Wisconsin)
W79-08943

ACID PRECIPITATION: CHEMISTRY AND FISH POPULATIONS IN 700 LAKES IN SOUTHERNMOST NORWAY,
Norsk Inst. for Vannforskning, Blindern.
R. F. Wright, and E. Snekvik.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 765-775. 4 fig, 2 tab, 17 ref.

Descriptors: *Sorlandet(Norway), *Acid precipitation, *Lakes, *Water chemistry, *Water pollution effects, *Fish, Acidic water, Water pollution sources, Brown trout, Salmo trutta, Norway, Environmental effects, Fish reproduction, Conductivity, Hydrogen ion concentration, Ions, Salts, Calcium, Sodium, Chlorine, Magnesium, Coasts, Chemical analysis.

Water chemistry and fish data for 700 small lakes (0.1-1.0 sq km) in the Sorlandet area of southern Norway were analyzed in 1974-75. Comparison with data on acid precipitation showed that precipitation chemistry dominates lake water chemistry in the area, and acid stress has resulted in elimination of fish populations from about 40% of the lakes. Another 40% of the lakes have sparse populations of the fish, mainly brown trout (salmo trutta). The lakes displayed distinct and regular geographic patterns of water chemistry: (1) pH levels followed a gradient ranging from 4.4-4.6 near the coast to 5.0-5.2 100 km inland; (2) sulfate concentrations followed a similar gradient; and (3) chlorine and sodium gradients were markedly

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steeper. These patterns reflected precipitation chemistry gradients; concentrations of sea-salt components such as chlorine, sodium, and magnesium, were highest near the coast, declining rapidly inland, while concentration gradients for long-range transported components such as H(+) and sulfate were less steep. Fish reproduction is most affected by acid stress, with loss of fish populations due primarily to recruitment failure, though adult fishkills have also occurred. Multiple regression analysis indicates pH and calcium are the most important factors affecting the fish; calcium apparently ameliorates acid stress, probably by reducing sodium loss. Acid stress to fish appears more acute in waters of very low ionic strength. (Lynch-Wisconsin)
W79-08944

SOME OBSERVATIONS ON RED-COLOURED SPECIES OF OSCILLATORIA (CYANOPHYCEAE) IN NUTRIENT-ENRICHED LAKES OF SOUTHERN NORWAY,
Norsk Inst. for Vannforskning, Blindern.
O. M. Skulberg.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 776-787. 7 fig, 3 tab, 27 ref.

Descriptors: *Norway, *Lakes, *Cyanophyta, *Oscillatoria, *Eutrophication, *Water pollution effects, Agricultural runoff, Domestic wastes, Sewage disposal, Succession, Algae, Phytoplankton, Lake Steinsfjorden(Norway), Lake Mjosa(Norway), Lake Gjersjoen(Norway), Pigments, Phycobilins, Photosynthesis, Oscillatoria rubescens, Oscillatoria bornetii, Oscillatoria agardhii, Classification, Identification, Trophic level, Aphanizomenon flos-aquae, Anabaena flos-aquae, Red trichomes.

Observations on cyanophytes in eutrophic lakes of southern Norway are summarized, and the invasion of species of Oscillatoria in lakes and slow rivers is described, with an account of three red-colored Oscillatoria species. Planktonic investigations have been carried out since 1957, with intensive studies of some inland waters enriched by agricultural runoff and sewage, including Lakes Mjosa, Steinsfjorden, and Gjersjoen, the River Glama, and the Halden watercourse. About 16 of 54 cyanophyte species are common, some capable of forming dense blooms, especially Anabaena flow-aquae, Aphanizomenon flos-aquae, and Oscillatoria spp. Formation of Oscillatoria blooms is closely associated with lake progression from oligotrophy to eutrophication. Only a few of the 15 Oscillatoria species reported form blooms: Q. agardhii, O. agardhii var. isothrix, O. agardhii var., O. bornetii f. tenuis, and O. rubescens. Among successful invading bloom-forming Oscillatoria species, three with red-colored trichomes are remarkable; their occurrence in three lakes is discussed: (1) O. agardhii var., Lake Gjersjoen; (2) O. rubescens, Lake Steinsfjorden; and (3) O. bornetii f. tenuis, Lake Mjosa. O. agardhii has an efficient pigment synthesis regulatory mechanism which maintains optimum pigment content under varying environmental conditions, and the presence of phycobilins as accessory photosynthetic pigments may provide an ecological advantage under low-light conditions. (Lynch-Wisconsin)
W79-08945

RELATIONSHIP BETWEEN HETEROTROPHIC BACTERIA AND PHYTOPLANKTON IN EUTROPHIC LAKE WITH WATER BLOOMS DOMINATED BY OSCILLATORIA AGARDHII,
Norsk Inst. for Vannforskning, Blindern.
K. Ormerod.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 788-793. 4 fig, 3 tab, 8 ref.

Descriptors: *Oscillatoria agardhii, *Eutrophication, *Nutrient regeneration, *Organic matter, *Bacteria, *Lake Gjersjoen(Norway), Heterotrophy, Phytoplankton, Algae, Lakes, Water pollution effects, Red trichomes, Cytophaga, Cyanophyta, Particulates, Depth, Epilimnion, Stratification, Nutrients, Cycling nutrients, Norway.

Study of heterotrophic bacteria in eutrophic Lake Gjersjoen, Norway in 1972-73 to determine their role in plant nutrient regeneration showed that total heterotrophic plate count is not a good measure of bacteria actively involved in nutrient regeneration, and that separate counting of different colonies gives better results. Despite low epilimnetic nutrient levels during autumn blooms, photosynthetic activity by phytoplankton did not decrease. Strong summer stratification indicated hypolimnetic regeneration of plant nutrients could not affect phytoplankton nutrient supply, and so was not considered. The red-colored variant of Oscillatoria agardhii dominated phytoplankton during particulate organic matter (POM) density peaks in June-July and October. As it was assumed that phytoplankton would use plant nutrients as quickly as they were regenerated, no increases in nutrient concentrations were expected or found during periods of high bacterial densities. On the other hand, high densities of heterotrophic bacteria were expected in periods of low nutrient concentrations and high POM densities, not the case when total colony count was used to calculate bacterial density. A correlation was found, however, when fluctuations in yellow colony bacteria were compared with POM. Dominance by these bacteria, many of which resembled Cytophaga, coincided with the red O. agardhii variant, but whether these bacteria actively degraded the phytoplankton or simply used organic matter excreted by them remains unknown. (Lynch-Wisconsin)
W79-08946

EFFECTS OF FISH REMOVAL FROM A SMALL LAKE,
Goteborg Univ. (Sweden). Dept. of Zoology.
J. A. E. Stenson, T. Bohlin, L. Henrikson, B. I. Nilsson, and H. G. Nymann.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 794-801. 10 fig, 14 ref.

Descriptors: *Lake Lilla Stockelidsvatten(Sweden), *Fish removal, *Food webs, *Ecology, *Predation, *Grazing, *Trophic level, *Oligotrophy, Biological communities, Fish, Lake Stora Stockelidsvatten(Sweden), Lakes, Bohuslan(Sweden), Size, Food habits, Roach, Perch, Leuciscus rutilus, Perca fluviatilis, Mathematical models, Model studies, Pyrrophyta, Succession, Eutrophication, Primary productivity, Algae, Phytoplankton, Ecosystems, Competition, Sweden, Cladocera, Copepods.

Experimental elimination with rotenone of all fish from one of two small adjacent lakes in Bohuslan, Sweden in November 1973 dramatically shift toward oligotrophy due to profound changes in the food web, especially in regard to body size and selective feeding. Removal of fish (dominated by roach, Leuciscus rutilus) from Lake Lilla Stockelidsvatten resulted in: (1) 90% reduction of limnetic primary production by 1975 (from about 17 mg C/cu m/hr in surface waters to less than 3 mg); (2) increase in net phytoplankton biomass with dominance by pyrrophytes (e.g., Ceratium hirundinella); (3) change in zooplankton dominance from small cladocerans (e.g., Bosmina longirostris) to large copepods (e.g., Eudiaptomus gracilis); (4) transparency increase probably due to a decrease in nannoplankton; (5) lower pH probably due to lower primary production; (6) decrease in total phosphorus concentration; and (7) increase in invertebrate plankton predators, such as Chaoborus sp. and Glaenocorisa propinqua. No similar changes occurred in Lake Stora Stockelidsvatten, whose fish population was dominated by roach and perch (Perca fluviatilis). A remineralization theory was developed to explain phytoplankton community changes by means of a nutrient recycling model: a shift from small grazers with large turnovers (cladocerans) to larger forms with low turnovers (calanoid copepods) caused increased grazer density, reduced phytoplankton density and production, and increased available nutrients, favoring algae which are weak competitors for nutrients and insensitive to grazing (pyrrophytes). (Lynch-Wisconsin)
W79-08947

INFLUENCE OF ACIDIFICATION ON DECOMPOSITION PROCESS IN LAKE SEDIMENT,
Lund Univ. (Sweden). Limnological Inst.
G. Andersson, S. Fleischer, and W. Graneli.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. part 2, p 802-807, 2 fig, 8 tab, 11 ref.

Descriptors: *Sweden, *Lakes, *Acid precipitation, *Acidic water, *Sediments, *Degradation(Decomposition), Oligotrophy, Hydrogen ion concentration, Lake Fiolen(Sweden), Lake Skarsjon(Sweden), Lake Tjarnesjon(Sweden), Lake Stora Neden(Sweden), Iron, Manganese, Silica, Zinc, Water chemistry, Respiration, Water pollution effects, Trophic level, Glucose, Phosphates, Nutrients, Sediment-water interfaces, Detritus.

Evaluation of effects of acidification on sediment processes through study of four Swedish lakes (two of which were acidified) showed that the bulk of sediment material was unaffected by the acid water. Because of the strong buffering capacity of the sediment, deeper sediment layers were not acidified, and only decomposition of material lying on the sediment surface, such as coarse detritus, is retarded by low pH. Low pH conditions (5.0-5.1 in summer) in Lakes Tjarnesjon and Stora Neden are probably due to acid precipitation. Summer pH in the control lakes, Fiolen and Skarsjon, was 6.8. In experiments on glucose turnover time, a series involving acclimatization for 26 days showed highest turnover time at pH 6.0 and shortest at 8.0, while a series with 98-day acclimatization showed longest turnover time and lowest glucose concentrations at pH extremes of 4.0 and 8.5, and shorter turnover times and high substrate concentrations at 6.0 and 7.0. The pH decrease did not lower sediment respiration below typical oligotrophic values. Acidification of water overlying Lake Tjarnesjon sediment resulted in low phosphate concentration in the water, whereas raising pH increased phosphate levels. With decreasing pH, release of iron from sediments decreased resulting in a decrease in water color, while release of manganese and zinc increased; reactive silica was not affected. (Lynch-Wisconsin)
W79-08948

EPILITHIC ALGAL PRESENCE AND PIGMENT COMPOSITION ON NATURALLY OCCURRING AND ARTIFICIAL SUBSTRATES IN LAKES TRUMMEN AND FIOLEN, SWEDEN,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
A. S. Rosemarin, and C. Gelin.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 808-813. 3 fig, 7 ref.

Descriptors: *Periphyton, *Epilithic, *Pigments, *Lake Trummen(Sweden), *Lake Fiolen(Sweden), *Artificial substrates, *Bioindicators, Testing procedures, Research equipment, Algae, Sessile algae, Lakes, Sweden, Eutrophication, Oligotrophy, Trophic level, Substrates, Rocks, Benthic flora, Chlorophyll, Pheopigments, Glass slides, Plastics, Granites, Succession.

Glass, plexiglas, and red granite were compared with natural rock substrates to test their suitability for experiments with epilithic flora. Tests were conducted in oligotrophic Lake Fiolen and eutrophic Lake Trummen, Sweden. The artificial substrates were cut to microscope slide size, placed vertically (one each) in uncovered plastic slide boxes with the bottom removed, and, secured to a brick, set out at 0.5-m depths on the littoral bottom in October 1975, and in February, April, May, and

June 1976. One unit was removed from each installation 19 June and 21 July 1976, along with naturally occurring rocks. In Lake Fiolen chlorophyll-a and pheopigment-a concentrations were consistently higher on the natural substrates than on the artificial ones; chlorophyll densities were relatively uniform regarding age of substrate. In Lake Trumman pigment density varied greatly by age of substrate. For the 19 June sample, density increased gradually except for the four-month substrate, which had pigment densities almost twice those of natural ones, probably caused by a very small coccoid cyanobacterium peculiar to these substrates. Pigment densities for the 21 July sample were relatively uniform for all substrates. Algal degradation as expressed by pheopigment concentrations may be a good means of comparing natural and artificial substrates. Granite and plexiglas appear preferrable to glass for testing. Pigment densities were very similar for the two lakes, indicating periphyton standing crop is not a good indicator of trophic status. (Lynch-Wisconsin)
W79-08949

SITUATION OF TWENTY-FIVE SWEDISH LAKES NOW AND 40 YEARS AGO,
Uppsala Univ. (Sweden). Inst. of Limnology.
M. Wallsten.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 814-817, 3 fig, 6 ref.

Descriptors: *Lakes, *Sweden, *Conductivity, *Sulfates, *Phosphorus, *Water pollution effects, *Agricultural runoff, Nutrients, Macrophytes, Municipal wastes, Industrial wastes, Sewage disposal, Water levels.

Reinvestigation in 1975 of 25 Swedish lakes included among 167 studied by Lohammar in 1934 showed remarkable increases in conductivity, sulfate, and total phosphorus in many of the lakes, attributed to the influence of human activity. In 1934 conductivity ranged 20-600 microS/cm, compared with 30-1000 microS/cm in 1975. Sulfate concentrations nearly doubled in all lakes by 1975, and in several the increase was even more dramatic. In 1934 sulfate ranged about 0-48 mg/l, while in 1975 it ranged about 11-328 mg/l. In 11 of the 25 lakes total phosphorus showed little or no increase, while the rest showed moderate to very large increases. Since most of the lakes are located in agricultural areas, a higher increase was expected. Lakes which have received industrial and municipal sewage have exhibited notable increases. Total phosphorus in 1934 varied about 2-117 microg/l, and in 1975 about 8-372 microg/l. Though there are no macrophyte distribution maps from the 1930s, comparison of photographs from the two surveys showed no changes in the large lakes, such as Erken and Lilla Ullevifjarden, nor in some smaller woodland lakes. Some shallow lakes which had abundant aquatic vegetation in the 1930s, both emergent and floating, are now dominated by emergent species. Two of the 25 lakes have been filled in by vegetation since 1934, partially because of a lower water level. The greatest vegetative change in most lakes was in the supralittoral zone, now overgrown with shrubs. (Lynch-Wisconsin)
W79-08950

LONG-TERM CHANGES IN THE PROFUNDAL BENTHOS OF LAKE MALAREN,
National Swedish Environment Protection Board, Uppsala. Limnological Survey.
T. Wiederholm.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. part 2, p 818-824, 5 fig, 2 tab, 11 ref.

Descriptors: *Lake Malaren(Sweden), *Eutrophication, *Benthic fauna, *Phytoplankton, *Lake restoration, *Predation, *Water pollution control, Water level fluctuations, Lakes, Sweden, Municipal wastes, Sewage disposal, Organic matter, Nutrients, Algae, Biomass, Lake morphometry, Profundal zone, Species composition, Species diversity, Chironomidae, Fish, Competition, Chlorophyll, Primary productivity, Oligochaetes, Pontoporeia affinis, Crustaceans, Ruffe, Burbot.

Investigation of the composition and abundance of profundal benthic fauna in Lake Malaren, Sweden 1969-76 showed: (1) maxima of oligochaete abundance corresponded to peaks in chlorophyll concentration with a lag phase of 2-5 years; (2) drastic decline of the crustacean Pontoporeia affinis over the study period appears due increased fish-predation from ruffe (positively affected by eutrophication and decreased predation from burbot); and (3) increased chironomid abundance following the disappearance of Pontoporeia was probably the result of lower interspecific competition for food and space. Since 1970 strong measures have been taken to decrease or eliminate inputs of nutrients and organic matter from municipal sewage effluent to the lake, which had been showing signs of rapidly progressing eutrophication. Control efforts coincided with a period of reduced water flow through the lake caused by unusually low winter precipitation. Reduced loading has produced significantly improved water quality in terms of transparency and phytoplankton biomass. At a depth of 30 m oligochaetes dominated numerically at the beginning of the study period, with chironomids and Pontoporeia second. By the middle of the period Pontoporeia had almost disappeared and oligochaetes made up 80%, but by the end of the period chironomids were dominant. At 50 m crustaceans dominated at the beginning, then disappeared and oligochaets and chironomids became dominant. (Lynch-Wisconsin)
W79-08951

RESEARCH ON RECOVERY OF POLLUTED LAKES. I. IMPROVED WATER QUALITY IN LAKE BOREN AND LAKE EKOLN AFTER NUTRIENT REDUCTION,
Uppsala Univ. (Sweden). Inst. for Physiologic Botany.
C. Forsberg, S. O. Ryding, A. Forsberg, and A. Claesson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. part 2, p 825-832, 2 fig, 4 tab, 15 ref.

Descriptors: *Nutrient removal, *Phosphorus, *Lake Boren(Sweden), *Lake Ekoln(Sweden), *Eutrophication, *Water pollution control, Lake restoration, *Municipal wastes, Wastewater treatment, Tertiary treatment, Flocculation, Sweden, Lakes, Chlorophyll, Transparency, Phytoplankton, Algae, Cyanophyta, Vollenweider models, Model studies, Organic matter, Detritus, Nitrogen, Bioassay, Selenastrum capricornutum, Nutrients.

Studies in Lakes Boren and Ekoln in 1973-76 show that Sweden's program of phosphorus removal from municipal wastewater through construction of about 700 advanced treatment plants during the 1970s is effectively reducing lake eutrophication. Shallow Lake Boren has a short hydraulic residence time and is homothermal all year, while Lake Ekoln is deeper and is thermally stratified in winter and summer. Advanced wastewater treatment has reduced annual phosphorus loading by about 70% in both lakes. Phosphorus from the treatment plant at Motala has been reduced 30 to three tons/yr, and at Uppsala 100 to 20 tons/yr. Average chlorophyll-a in surface waters has decreased 50% 10 to five mg/cu m in Lake Boren, and 20 to 10 mg/cu m in Lake Ekoln. Annual phosphorus load had to be decreased 5-6 tons for each one mg/cu m of decrease in chlorophyll-a concentration. Phosphorus residence time was of the same order in both lakes, and in both transparency increased from 1.5-2.0 m as a summer average. Advanced treatment in Lake Boren was begun in May 1975, and rapid improvement was expected since it is supplied by oligotrophic water from Lake Vattern. Chemical wastewater treatment (flocculation of phosphorus) resulted in immediate improvement in the form of lower chlorophyll and higher transparency, and cyanophytes decreased significantly. In Lake Ekoln improvements included displacement of cyanophytes from Microcystis in 1970 to Oscillatoria in 1971. Vollenweider models were used to assess trophic status. (Lynch-Wisconsin)
W79-08952

RESEARCH ON RECOVERY OF POLLUTED LAKES. II. BIOMASS BUDGETS USING NATURAL AND POTENTIAL (ALGAL ASSAY) CHLOROPHYLL A,
National Swedish Environment Protection Board, Uppsala. Inst. of Physiological Botany.
S. O. Ryding, A. Claesson, and A. Forsberg.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 833-839, 3 fig, 4 tab, 2 ref.

Descriptors: *Chlorophyll, *Biomass, Budgets, *Lake restoration, *Sweden, *Nutrient removal, *Algal growth potential, *Nutrient loading, Nutrients, Biomass, Bioassay, Selenastrum capricornutum, Chlorophyta, Analytical techniques, Wastewater treatment, Phosphorus, Lake Garan(Sweden), Lake Sillen(Sweden), Lake Molkomsjon(Sweden), Lake Glaningen(Sweden), Eutrophication, Water pollution control, Algae, Mass balance, Phytoplankton, Municipal wastes.

Although phosphorus removal from municipal effluents in Sweden has been in effect for several years, water quality in some eutrophic lakes has not yet improved. Four such lakes were studied using 1973-75 data to determine reasons for the delayed recovery. This paper focuses on lake biomass budgets in terms of natural and potential chlorophyll-a as measured by Selenastrum capricornutum assays. Maximum algal growth potential (AGP) was measured as cell volume and converted to potential chlorophyll-a. Marked decrease in phosphorus input to the two shallow lakes, Glaningen (60% decrease) and Garan (75%), has led to net leakage of nutrients. Wastewater load to Lake Garan remains 66% of total load, and over half the nutrient input is still available for algal growth. Because of the lakes' highly fertilized state, it will be some time before a new equilibrium is reached between the new input and output. In the deeper lakes, Molkomsjon and Sillen, there is net accumulation of nutrients. In Molkomsjon, phosphorus concentration in wastewater effluent is still about 0.85 mg/l, and in Sillen any substantial improvement in water quality is prevented by: (1) low phosphorus reduction (30%), and (2) high degree of algal utilization of nutrients from the drainage basin, despite only 9% loading from the treatment plant and low availability of nutrients in wastewater for algal growth. Treatment plant contributions to total external loading ranged from 11-40% for nitrogen, 11-53% for phosphorus, and 9-78% for total chlorophyll-a. (Lynch-Wisconsin)
W79-08953

RESPONSE OF PHYTOPLANKTON AND PRIMARY PRODUCTION TO REDUCED NUTRIENT LOADING IN LAKE NORRVIKEN,
Uppsala Univ. (Sweden). Inst. of Limnology.
D. Ahlgren.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 840-845, 5 fig, 2 tab, 14 ref.

Descriptors: *Lake Norrviken(Sweden), *Lake restoration, *Diversion, *Phytoplankton, *Primary productivity, *Nutrient loading, *Eutrophication, *Biomass, Water pollution control, Sweden, Lakes, Algae, Sewage disposal, Chlorophyll, Carbon, Photosynthesis, Limiting factors, Seston, Net plankton, Oscillatoria agardhii, Species diversity, Cyanophyta.

A seven-year study of the recovery of Lake Norrviken, Sweden, following diversion of sewage effluent in 1969 showed that decreased nutrient supply decreased phytoplankton biomass and algal chlorophyll content, in turn resulting in lower primary production. No other restoration efforts were undertaken and recovery therefore has been entirely natural. Chlorophyll decreased from 151 mg/l in 1969 to 60 ml/l in 1976, and the Brillouin

diversity index (H sub cell) increased 0.19-2.0. Long-time dominance of phytoplankton by Oscillatoria agardhii has diminished since 1969 and other cyanophytes have increased, including Anabaena, Microcystis, and Gomphosphaeria. Diatoms and chlorophytes also increased between 1974-1976. The production/chlorophyll ratio (assimilation number) was consistent 1970-76, indicating primary production decreased proportionately to chlorophyll concentration. Estimation of the production/biomass ratio, where biomass is measured as carbon, is difficult because of problems in measuring carbon; two methods are discussed. While the first (using chlorophyll and seston) is more reliable, the second, based on net plankton analysis, is attractive because individual values always can be determined and regression analyses of the first method are often inefficient for summer values. Photosynthetic capacity expressed as production/phytoplankton carbon has diminished relative to production/chlorophyll. (Lynch-Wisconsin)
W79-08954

RESPONSE OF LAKE NORRVIKEN TO REDUCED NUTRIENT LOADING,
Uppsala Univ. (Sweden). Inst. of Limnology.
I. Ahlgren.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 846-850, 3 fig, 1 tab, 11 ref.

Descriptors: *Lake Norrviken(Sweden), *Nutrient loading, *Diversion, *Lake restoration, *Eutrophication, Phosphorus, Nitrogen, Lakes, Sweden, Water pollution control, Nutrients, Biomass, Phytoplankton, Algae, Species diversity, Primary productivity, Chlorophyll, Trophic level, Secchi disks, Sediments, Vollenweider models, Water quality indices.

Heavily eutrophic Lake Norrviken (central Sweden) has shown significant improvement in nutrient concentrations, phytoplankton biomass, species diversity, and primary productivity since sewage has been diverted from a yeast factory beginning in 1969. Based on a Secchi disk transparency index, the lake is improving at about the same rate as Lake Washington (Washington), and the time needed for both to reach their baselines may be about 15 years. According to Vollenweider criteria, critical phosphorus loading to Lake Norrviken would be 0.1-0.2 g P/sq m/yr, while normal background loading is about 0.2-0.3 g, indicating the lake was meso-eutrophic even before being polluted by sewage. In 1961-62 the yeast factory was responsible for 80% of nitrogen and 70% of phosphorus inputs to the lake. Total nitrogen loading was 66.5 g/sq m/yr in 1961-62, compared with only 2.4 g in 1976, and total phosphorus loading declined from 4.05 g/sq m/yr to 0.09 g. Sediment phosphorus retention was positive for all years 1961-62, 1970-76 except for 1971, and the average retention coefficient for 1970-76 was 0.1 (i.e., 10% of incoming phosphorus was accumulated in the sediment). Negative nitrogen retention occurred in 1971 and 1975, with an average retention coefficient of 0.2 During summer, sediment is the most important source of nitrogen and phosphorus to the water. Inorganic nitrogen has decreased more rapidly than inorganic phosphorus, and nitrogen appeared to be the primary limiting factor for phytoplankton 1970-74. (Lynch-Wisconsin)
W79-08955

SOME EFFECTS OF THE ACIDIFICATION OF SWEDISH LAKES,
National Swedish Environment Protection Board, Stockholm. Research Lab.
W. Dickson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 851-856, 5 fig, 6 ref.

Descriptors: *Sweden, *Lakes, *Aluminum, *Acidic water, *Hydrogen ion concentration, *Acid precipitation, Toxicity, Fish, Buffers, Water pollution effects, Lime, Phytoplankton, Algae, Transparency, Dry fallout, Sulfur, Water pollution treatment, Fossil fuels, Organic matter, Phosphorus, Nutrients, Geology, Salts, Bedrock, Water pollution sources.

Swedish lakes are particularly susceptible to acidification because bedrock consists mostly of slowly weathering granites, gneiss, and porphyries which render inland waters low in salts and poorly buffered. Acid atmospheric precipitation (pH 4.0-4.5) and dry deposition therefore greatly affects the lakes. Dry deposition accounts for the high sulfur concentration in lake waters of the west coast (0.3 mg/l or more). Aluminum concentrations in Swedish west-coast lake waters increased with decreasing pH from 10 to over 600 microg/l in data from summer and autumn 1976. Above pH 5.5, aluminum solubility is low and excess aluminum is precipitated. Organic matter may form complexes with aluminum, and solutions of near-neutral pH may contain several times the aluminum levels predicted from solubility data. Aluminum is an efficient precipitator of humic substances, however, resulting in increased lake transparency with increased aluminum levels at low pH, a factor contrasting with larger phytoplankton biomasses in acidic lakes. Aluminum also easily precipitates dissolved phosphorus especially at pH 5-6, and field observations often show that extremely acidic lakes have larger phytoplankton biomasses than those in the pH 5.0-5.5. range. Levels of 0.2-0.6 mg Al/l considerably increase toxicity to fish of low-pH water, with the lethal limit at about 0.7 mg/l. Liming has been a successful treatment of acidic lakes, in terms of both pH and biota. (Lynch-Wisconsin)
W79-08956

EXPERIMENTAL LAKE FERTILIZATION IN THE KUOKKEL AREA, NORTHERN SWEDEN: BUDGET CALCULATIONS AND THE FATE OF NUTRIENTS,
Uppsala Univ. (Sweden). Inst. of Limnology.
M. Jansson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 857-862, 7 tab, 6 ref.

Descriptors: *Nutrient budgets, *Phosphorus, *Nitrogen, *Lake Hymenjaure(Sweden), *Lake Magnusjaure(Sweden), *Sediments, *Subarctic, Nutrients, Lakes, Sweden, Kuokkel area(Sweden), Denitrification, Nitrogen fixation, Cold regions, Fertilization, Eutrophication, Dry fallout, Precipitation(Atmospheric), Nutrient loading, Buffers, Lake Stufsjon(Sweden).

Experimental fertilization of Lakes Hymenjaure and Magnusjaure (Kuokkel area of northern Sweden) with nitrogen and phosphorus, singly or in combination, resulted in rapid and permanent incorporation of phosphorus into sediments. Phosphorus fertilization caused increased nitrogen loading due to nitrogen fixation, and excess nitrogen accumulated in its inorganic form in lake water and was denitrified. The experimental lakes have a high phosphorus-retention capacity (80-90%) primarily through incorporation into sediments, which also holds true when phosphorus occurs in excess in lake water. For nitrogen, on the other hand, the lakes have endogenous buffering systems allowing elimination of excess nitrogen by denitrification and compensation for nitrogen-limiting situations through nitrogen fixation. Lake Stugsjon served as an experimental control. The lakes are located in a subarctic region, and have areas of 1-2 ha and maximum depths of 4.5-5.5 m. Summer mean water temperature is 8.5-10.0 C, and the lakes do not stratify. Natural nutrient concentrations are 200 microg/ N/l and four microg P/l in Lake Magnusjaure. Nutrients were added during the ice-free period (100-130 days/yr) at 2.02-7.04 kg P/wk (1972-75) and 89.6 kg N (1974-75) Lake Hymenjaure, and 4.64 kg P (1975) and 52.5-56.0 kg N (1974-75) in Lake Magnusjaure. Nutrient balances are given. (Lynch-Wisconsin)
W79-08957

EXPERIMENTAL LAKE FERTILIZATION IN THE KUOKKEL AREA, NORTHERN SWEDEN: CHANGES IN SESTONIC CARBON AND THE ROLE OF PHYTOPLANKTON,
Uppsala Univ. (Sweden). Inst. of Limnology.
A. Lundgren.
In: Proceedings: 20th Congress, Internationale Vereingung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 863-868, 3 fig, 9 ref.

Descriptors: *Phytoplankton, *Seston, *Detritus, *Lake Hymenjaure(Sweden), *Lake Magnusjaure(Sweden), *Carbon, *Subarctic, Biomass, Algae, Primary productivity, Lakes, Kuokkel area(Sweden), Sweden, Lake Stugsjon(Sweden), Eutrophication, Nutrients, Fertilization, Nitrogen, Phosphorus, Tripton, Cold regions, Dinoflagellates, Chrysomonads, Food chains, Oligotrophy.

Addition of inorganic phosphorus and nitrogen to subarctic Lakes Hymenjaure and Magnusjaure in Sweden's Kuokkel region produced both a quantitative increase in seston and a qualitative change from dominance of seston by detritus to dominance by phytoplankton containing high nutritive value. This change affects both filter feeders and higher trophic levels. Detritus is quantitatively important in most aquatic ecosystems and usually dominates the seston. The two lakes (plus the control, Lake Stugsjon) are naturally nutrient-poor (4-7 microg P/l and 100-200 microg N/l), are 1-2 ha in area, and have a maximum depth of 4.5-5.5 m. Dissolved solids concentration is low, with mean specific conductivity of 15-18 micro S/cm, mean pH of 6.2-6.8, and alkalinity of 0.02-0.06 meq/l. Phytoplankton never contribute more than 10% of total sestonic carbon in Lake Stugsjon, and detrital carbon dominate with a mean of 250 microg C/l. Changes in detrital carbon were not correlated to changes in phytoplankton biomass or production, but may be governed by resuspension rate from sediments. Mean detrital carbon was 170 microg C/l in Lake Magnusjaure and 460 microg/l in Lake Hymenjaure, but fertilization increased sestonic carbon more than 10 times, due solely to increased phytoplankton biomass. The latter contributed 37% of sestonic carbon in Lake Magnusjaure in 1974 and 81% in 1975 after fertilization; in Lake Hymenjaure the figures were 26% and 78%, excluding the Coccomyxa coccoides collapse in September 1975. (Lynch-Wisconsin)
W79-08958

EXPERIMENTAL LAKE FERTILIZATION IN THE KUOKKEL AREA, NORTHERN SWEDEN: DISTRIBUTION, BIOMASS AND PRODUCTION OF THE SUBMERGED MACROPHYTES,
Uppsala Univ. (Sweden). Inst. of Limnology.
D. Solander.
In: Proceedings: 20th Congress, Internationale Vereingung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 869-874, 4 fig, 2 tab, 9 ref.

Descriptors: *Submerged plants, *Lake Hymenjaure(Sweden), *Lake Stugsjon(Sweden), *Biomass, *Nutrients, *Isoetes echinospora, *Sparganium, *Subarctic, Distribution, Primary productivity, Seasonal, Weight, Roots, Shoots, Eutrophication, Sweden, Kuokkel area(Sweden), Fertilization, Nitrogen, Phosphorus, Cold regions, Lakes, Water temperature.

Enrichment of Lake Hymenjaure (Kuokkel region, Sweden) with nitrogen (1975) and phosphorus (1972-75) produced few significant changes in the submerged macrophytes Isoetes echinospora and Sparganium sp. in contrast to unfertilized Lake Stugsjon. Water temperature was most important in determining maximal shoot weight for Isoetes and to a lesser extent for Sparganium. During 1972-75 both species were more dense in Lake Stugsjon than in Lake Hymenjaure; in the former Isotes ranged 1700-2200 plants/sq m (mean 2000) and Sparganium 2800-4100 plants/sq m (mean 3500), and in Lake Hymenjaure Isoetes ranged 850-1700 plants/sq m (mean 1100) and Sparganium 2000-3100 plants/sq m (mean 2500). No particular pattern was observed, except for a steady increase

of Isoetes in Lake Hymenjaure. Densities in the lakes were in the upper range among lakes; plants of both species were dwarf forms. In general, peak shoot weight and mean shoot biomass declined for both species in both lakes 1972-75 with biomass higher in Lake Stugsjon as a result of higher plant density there. An exception to the general decline was an increase of Isoetes in Lake Hymenjaure from 2.1 g dry wt/cq cm in 1974 to 3.9 g in 1975. Proportion of roots in total plant biomass of both species followed a seasonal pattern, peaking at ice break (67% in Isoetes and 51% in Sparganium). Annual shoot production of both species was normally 1.6 times seasonal mean biomass. Macrophytes did not respond to nutrient addition to the same degree as phytoplankton. (Lynch-Wisconsin)
W79-08959

EXPERIMENTAL LAKE FERTILIZATION IN THE KUOKKEL AREA, NORTHERN SWEDEN: THE RESPONSE BY THE PLANKTONIC ROTIFER COMMUNITY,
Uppsala Univ. (Sweden), Inst. of Limnology.
G. Persson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 875-880, 1 fig, 4 tab, 7 ref.

Descriptors: *Zooplankton, *Rotifers, *Nutrients, *Lake Stugsjon(Sweden), *Lake Hymenjaure(Sweden), *Conchilus unicornis, *Abundance, *Subarctic, Biomass, Eutrophication, Fertilization, Sweden, Lakes, Nitrogen, Phosphorus, Cold regions, Kuokkel area(Sweden), Kellicottia longispina, Polyarthra vulgaris, Colloteca mutabilis, Succession, Species composition, Population dynamics, Mortality, Longevity, Recruitment, Phytoplankton, Algae, Chrysophyta, Biological communities.

Phosphorus and nitrogen enrichment of subarctic Lake Hymenjaure (Kuokkel region, Sweden) generally caused no significant changes in populations of planktonic rotifers, compared with unfertilized Lake Stugsjon. Total community abundance for all years (1972-75) was typically unimodal with one summer peak dominated by Conochilus unicornis. The only notable deviation was a great Conochilus peak in 1975 in Lake Hymenjaure at 1342 ind/l, accounted for primarily by lower mortality (increased longevity) in Lake Hymenjaure, and secondarily by higher recruitment rates. Phosphorus was added to the lakes during the summers of 1972-74, and both phosphorus and nitrogen during summer 1975. Among phytoplankton the normal chrysophycean community was supplanted by one dominated by the chlorococcoid green alga Coccomyxa coccoides, a shift which occurred each year from 1973 on. Parallel increases in particulate carbon and bacteria also occurred. Of 13 rotifer species, the most important were Kellicottia longispina, Polyarthra vulgaris, C. unicornis, and Colloteca mutabilis. An annual succession occurs: (1) Keratella hiemalis and Notholca squamula appear under spring ice and disappear after ice break in mid-June; (2) with ice break C. unicornis hatches and rapidly outnumbers other species at a peak abundance of 50-300 ind/l; and (3) P. vulgaris peaks later in July accompanied or followed by K. longispina, with small populations of both persisting under winter ice. (Lynch-Wisconsin)
W79-08960

DAY TO DAY VARIATIONS IN THE PHYTOPLANKTON COMMUNITY IN THREE BROWN-WATER LAKES IN FINLAND,
Helsinki Univ. (Finland). Dept. of Botany.
V. Ilmavirta.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 881-885, 3 fig, 4 tab, 9 ref.

Descriptors: *Lake Paajarvi(Finland), *Lake Suomunjarvi(Finland), *Lake Lovojarvi(Finland), *Phytoplankton, *Primary productivity, *Weather, Lakes, Finland, *Algae, *Color, Diel migration, Biorhythms, Cryptophytes, Diatoms, Chrysophyta, Solar radiation, Clouds, Turbulence, Mixing, Biomass, Monitoring, Sampling, Chlorophyll, Shading, Oligotrophy, Eutrophication, Metabolism, Nutrients, Carbon radioisotopes.

Large daily meteorological and biological variations affecting primary productivity (such as cloud cover and irradiation, turbulence and mixing, and phytoplankton biomass) observed over six consecutive days (June 1975) in three Finish lakes demonstrate that use of single-day results could yield misleading research conclusions. The lakes were oligotrophic, mesohumic Lake Suomunjarvi; oligotrophic, brown-water Lake Paajarvi; and eutrophic, polyhumic Lake Lovojarvi. Chemical properties among the lakes differed greatly, but not within a lake. Total variation varied significantly. In Suomunjarvi and Lovojarvi phytoplankton biomass distribution by taxa showed no significant variation, but in Paajarvi an increase in the percentage of diatoms and decrease of cryptophytes was significant, due apparently to calm and sunny weather forcing cryptophyte to deeper layers, with subsequent dominance by diatoms with lower metabolic activity. Production in Lovojarvi correlated with irradiation, due to high water color and dense phytoplankton crops in the epilimnion (which also shaded subsurface waters). In Suomunjarvi production correlated with biomass and slightly with radiation (only in glass bottles). A significant correlation of production to irradiation in Paajarvi observed in previous studies was not evident, caused by the major decline in cryptophyte biomass during the last three days. Average total production in Lovojarvi ranged 564-920 mg C sub ass/sq m, in Paajarvi 125-330 mg, and in Suomojarvi 14.4-30.4 mg. (Lynch-Wisconsin)
W79-08961

SPATIAL PATTERNS OF LITTORAL MEIOFAUNA IN AN OLIGOTROPHIC LAKE,
Helsinki Univ., Lammi (Finland). Lammi Biological Station.
E. Ranta, and J. Sarvala.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 886-890, 3 fig, 1 tab, 12 ref.

Descriptors: *Spatial distribution, *Analytical techniques, *Benthic fauna, *Littoral, *Lake Paajarvi(Finland), *Meiofauna, Methodology, Lakes, Finland, Oligotrophy, Grids, Quadrats, Cladocera, Pisidium, Hydracarina, Oligochaetes, Ceratopogonidae, Model studies, Ostracoda, Tardigrada, Mapping, Random, Habitats, Aggregation, Distribution patterns, Poisson ratio.

Spatial patterns of littoral meiofauna in oligotrophic Lake Paajarvi in southern Finland were analyzed by means of grids. In October 1976 a 20 x 20-cm bottom sample was taken with a grid of 100 four-sq cm units, and in August 1976 four nested areas were sampled: (1) 4.5 sq m, (2) about 500 sq m, (3) 10,000 sq m, and (4) the 1.2-1.5 depth zone of the entire lake. Two 2.0-sq mm subsamples were taken from 10 sites in each area. Twelve taxonomic groups were identified and counted, with the total as an additional group. A Poisson distribution could be rejected for all but Ceratopogonidae, Hydracarina, and Pisidium, in which mean number of individuals per unit was low (0.93-1.64), but observed frequency distribution for all groups agreed well with the negative binomial distribution. Nonrandomness was also indicated by the variance/mean ratio, higher than 1.0 in all except the three aforementioned groups. Results suggested aggregation within the grid, which was studied with a method proposed by Krishna Iyer (1949), classifying grids units containing fewer individuals than the mean as sparse and those with more as dense. In all groups but Tardigrada and Ostracoda observed and expected numbers of joins tallied well indicating a random pattern of aggregations. Grid data were also analyzed with Goodall's method (1974) and the Skellan model (1952). Calculations based on variances for the whole lake showed that for all groups with a mean count of 10 or more/unit, 21 units, 21 units of four sq cm gives a mean abundance estimate within 40% of the true value. (Lynch-Wisconsin)
W79-08962

BIOASSAY AND IN SITU STUDIES ON PRODUCTIVITY IN A COASTAL MEROMICTIC LAKE,
Abo Akademi, Turku (Finland). Inst. of Biology.
T. Lindholm.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 891-894, 5 fig, 1 tab, 2 ref.

Descriptors: *Lake Vastra Kyrksundet(Finland), *Meromixis, *Aland Island(Finland), *Stagnant water, *Uplifting, *Eutrophication, *Primary productivity, *Lake restoration, Upwelling, Nutrients, Hydrogen ion concentration, Seas, Lakes, Finland, Bioassay, On-site tests, Phytoplankton, Algae, Baltic Sea, Bacteria, Anaerobic conditions, Oxygen demand, Deep water, Sampling, Carbon radioisotopes, Coasts.

Stagnant, anoxic, and nutrient-rich deep water in meromictic Lake Vastra Kyrksundet on Aland Island in the Baltic Sea (Finland) is uplifted by irregular influxes of Baltic Sea water, and causes remarkable increases in phytoplankton production; restoration of such coastal lakes requires special treatment of the stagnant water. Bioassay tests with natural phytoplankton communities were used to complement in-situ productivity studies in 1976. Bioassay results showed stagnant water doses of more than 0.25% by volume caused immediate decrease in carbon-14 uptake, while smaller doses produced slight, but not statistically significant increases in productivity. Addition of 1.25% always caused significant changes, with a productivity peak after two days. A 10% dose immediately reduced carbon-14 uptake to less than 10% of controls, oxygen content from 9.3 to 6.1 mg/l, and pH from 8.2 to 7.5. After four days, however, carbon-14 uptake was almost 18 times higher than controls, with high oxygen demand of 22 mg/l. Baltic water or freshwater alone had no effect on productivity. Bioassays gave more information of potential production than years of field measurements. In Lake Vastra Kyrksundet over 50% of the water volume may be anaerobic, and deep water contains several mg/l of hydrogen sulfide, ammonia, and phosphate. Such uplifting in the meromictic Aland Lakes gives them a special productivity rhythm. (Lynch-Wisconsin)
W79-08963

HELSINKI METROPOLITAN AREA WATER SUPPLY AND WATER QUALITY IN LAKE PAIJANNE,
Hydrobiological Research Inst., Jyvaskyla (Finland).
H. Harjula, and K. Granberg.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 895-899, 2 fig, 1 tab, 7 ref.

Descriptors: *Lake Paijanne(Finland), *Helsinki(Finland), *Water supply development, *Water pollution control, *Municipal water, *Water supply, *Tunnels, Water sources, Lakes, Finland, Eutrophication, Water pollution sources, Pulp and paper industry, Lake restoration, Waste water treatment, Sewage treatment, Water conveyance, Effluents, Biochemical oxygen demand, Planning, Suspended solids, Lignin, Oligotrophy.

To provide for future water supply needs of Helsinki, Finland, a tunnel will link the city with Lake Paijanne, Finland's second-largest watercourse located 120 km to the northeast. Helsinki is expected to grow from 900,000 to about 1.1 million by the year 2000, with increased water demand from four cu m/sec to 7-8 cu m/sec. Total water resources of the Helsinki region are 5.8 cu m/sec, of which 0.8 cu m/sec is provided by groundwater. The tunnel, selected in place of desalination of seawater, was begun in 1973, and the entire system will be completed by 1982. The tunnel is 30-130 m deep in good quality bedrock (granite and gneiss). For flows of 0-10 cu m/sec gravitation is sufficient, but

for flows of 10-20 cu m/sec one to three pumping stations are necessary. Eutrophication and pollution began 25-30 years ago in the naturally oligotrophic and oligohumous lake; pollution was most severe in the 1960s. Water pollution control measures have brought water quality in the southern part of the lake (where the supply intake is located) to a level approaching the natural state. The pulp and paper industry is the most serious pollution source to the lake. Numerous in-plant improvements and external effluent treatment have resulted in considerable reductions in BOD, suspended solids, and lignin; chemical wastewater treatment is planned for the late 1970s. Sewage treatment involves mechanical, chemical, and biological methods. (Lynch-Wisconsin)
W79-08964

SIGNIFICANCE OF PRIMARY PRODUCTION AND PRODUCTION OF HETEROTROPHIC BACTERIA ON THE OXYGEN CONTENT OF LAKE PAIJANNE,
Hydrobiological Research Inst., Jyvaskyla (Finland).
K. Granberg.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 900-904. 1 fig, 5 tab, 12 ref.

Descriptors: *Lake Paijanne(Finland), *Primary productivity, *Bacteria, *Oxygen, *Hypolimnion, *Pulp wastes, Productivity, Lakes, Finland, Organic matter, Sulfite mills, Heterotrophy, Phytoplankton, Algae, Lignin, Degradation(Decomposition), Sedimentation, Chemical oxygen demand, Biochemical oxygen demand, Water pollution effects.

In central Lake Paijanne, Finland, Bacterial production greatly exceeded primary production 1970-76, indicating the significance of allochthonous organic material in pollutants, specifically lignin compounds of pulp mill wastes. The lake is polluted primarily by sulfite pulp mill effluents, which inhibit primary production, and also by human wastes. High pulp mill effluent loading stimulates bacterial production. In nonhumic unpolluted lakes the main cause of hypolimnetic oxygen consumption is generally primary production, until about 30 years ago Lake Paijanne was a clear, oligotrophic lake. In cleaner waters, the effect of pulp mill organic wastes is comparable to humus, and in humic waters bacterial production can exceed primary production. The oxygen content of the hypolimnion is mainly affected by sedimentation of organic substances. Present lake COD varies 8-16 mg 02/1, with much of the COD due to the pulp mill effluents; about 50% of long-term BOD in the effluents is due to lignin compounds. The correlation coefficient between COD and lignin concentration of the water is relatively high, varying 0.57-0.83. At four stations, growing season primary production ranged from 3.4-7.1 g C/sq m in 1970 to 10.8-15.6 g in 1972 and 16.9-23.4 g in 1976, compared with bacterial production of 59.8-111.9 g C/sq m in 1970, 77.5-127.1 g in 1972, and 49.9-120.0 g in 1976. Observed oxygen concentration in the hypolimnion were 0.4-6.7 ml/1 in 1970, 0.2-8.2 in 1972, and 1.5-9.8 in 1976. (Lynch-Wisconsin)
W79-08965

INTERRELATIONSHIPS OF PHYTOPLANKTON AND ZOOPLANKTON PRODUCTION IN SOME LAKES OF CENTRAL FINLAND,
Hydrobiological Research Inst., Jyvaskyla (Finland).
L. Hakkari.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 905-909, 3 fig, 1 tab, 16 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Lake Paijanne(Finland), *Primary productivity, *Bacteria, *Secondary productivity, Algae, Lake Leppavesi(Finland), Lake Kuusvesi(Finland), Lakes, Pulp wastes, Sulfite mills, Lignin, Food habits, Feeding rates, Grazing, Eutrophication, Oligotrophy, Organic matter, Herbivores, Finland, Rotifers, Tripton, Cryptomonas, Rhodomonas, Flagellates, Microorganisms, Water pollution effects.

Studies in three Finish lakes, two polluted by organic sulfite pulp mill effluents, showed that phytoplankton production varied 11-13% (meand 48%) of herbivorous zooplankton consumption, assuming the latter is four times their net production. Lowest percentages occurred in areas where primary production was inhibited by the pulp mill wastes, but even in noninhibitive contaminated areas zooplankton production exceeded phytoplankton production. In waters with lignin content over 1.0-1.5 mg/l, primary production was lower than zooplankton food demand, and thus zooplankton production in such areas was based on allochtonous organic matter or decomposed bacteria a finding matching those from natural humic waters. In areas strongly affected by the pulp mill effluents bacterial production was many times greater than phytoplankton production, and zooplankton food demand varied 21-55% of net production of bacteria and planktonic algae combined. The correlation between net phytoplankton production and herbivorous zooplankton production was significant (r=0.62), an expected result since phytoplankton were made up of large numbers of Cryptomonas spp., Rhodomonas spp., and small flagellates (all suitable food for zooplankters). Cyanophytes were almost lacking. Study lakes were moderately eutrophic Lake Paijanne and Lakes Leppavesi and Kuusvesi. Data were collected 1969-72 and 1976, primarily in Lake Paijanne. Southern Paijanne and Lake Kuusvesi are relatively uncontaminated, while Lake Leppavesi and central Paijanne receive pulp mill wastes. (Lynch-Wisconsin)
W79-08966

EFFECTS OF PULP MILL EFFLUENTS ON THE CHANGES OF FISH STOCKS IN LAKE PAIJANNE,
Hydrobiological Research Inst., Juvaskyla (Finland).
J. Nyronen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 910-913. 2 fig, 1 tab, 5 ref.

Descriptors: *Lake Paijanne(Finland), *Pulp wastes, *Water pollution effects, *Fish, Oxygen depletion, Perches, Bream, Roach, Planktivores, Effluents, Predation, Abundance, Finland, Lakes, Fisheries, Creel census, Fishing.

Pulp mill effluent pollution of central Lake Paijanne (Finland's second-largest lake, 1090 sq km) has almost eliminated planktivorous coregonid fish species, vendace and whitefish, resulting in dominance of perch, roach, and bream. Planktivorous fish made up about 60% of total catches in the lake in its natural state, an average of 17 kg/ha/yr. In 1969 the proportion was only about 7%, and average catch less than one kg/ha/yr. In the three central basins 1968-70, 59% of the total catch came from Tiirinselka (vol. 184 million cu m), 25% from Lehtiselka (vol. 468 million cu m), and 16% from Judinsalonselka (vol. 2.8 billion cu m). In 1973, 52% came from Tiirinselka, 27% from Lehtiselka, and 21% from Judinsalonselka. By 1975, 50% came from Judinsalonselka, and 25% from each Tiirinselka and Lehtiselka. The hypolimnia of the latter two have been almost anoxic since the stagnation periods of 1969. During favorable oxygen conditions in Judinsalonselka fish stock abundance increased to about 15 kg/test series/day, and the proportion of perch has increased steadily. In the other two basins test catches have decreased to 6-8 kg/test series/day. Rapid decrease in effluent loading in the early 1970s caused a rise in young classes of perch and bream, and total catches in Tiirinselka and Lehtiselka increased 40-70% compared with 1968-70. A 1974 loading increase reversed the trend, with a decrease in young perch and bream and an increase in roach. Prey-predator ratios have increased in these two basins from 3.7-4.0 to 2.6-3.0, but decreased in Judinsalonselka from 1.5-2.2. (Lynch-Wisconsin)
W79-08967

FIRST DATA ON ATP IN LAKE LEMAN,
M. L. Mackinnon, B. Chassaing, and P. Olive.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 914-920, 5 fig, 8 ref.

Descriptors: *Lake Leman(Switzerland), *Adenosine triphosphate(ATP), *Indicators, *Microorganismsism, *Biomass, Switzerland, Lakes, Methodology, Measurement, Chlorophyll, Carbon, Phytoplankton, Algae, Bacteria, Zooplankton, Nearshore zone, Offshore zone.

Sensitivity of adenosine triphosphate (ATP) as an environmental parameter was assessed through study of the distribution of total microbial biomass (TMB) in Lake Leman, Switzerland. ATP was chosen to determine TMB because: (1) it is associated only with living matter; (2) its conversion to biocarbon is fairly constant; and (3) its method of determination is fast, sensitive to the ng/l, and reproducible (range of values on triplicate analysis 15% or less). Samples were collected January and April-May 1976 and analyzed for ATP and 25 other commonly measured parameters. Conclusions: (1) the amount of living matter in the lake was negligible in January, but quite large April-May; (2) in April most of the total microbial biomass was in the top 20 m of the Grand Lac and in the top 30 m of the Petit Lac; (3) at 0.20 m there was more living matter offshore than inshore, and the ATP peak was closer to the surface at offshore than inshore stations; (4) ATP varied more offshore than between offshore and inshore; and (5) industrial urban wastes had no significant effect on development of total microbial biomass. Data on chlorophyll-a and biocarbon percentage correlated with data on ATP. Biocarbon percentage maxima occurred 5 m below the living matter maxima. Three biological zones were distinguished. Between January and April-May ATP increased 40 times, carbon assimilation rate 30 times chlorophyll-a 20 times, and POC three times. (Lynch-Wisconsin)
W79-08968

A COMPARISON OF SOME LIMNOLOGICAL CHARACTERISTICS OF TWO SMALL LAKES IN THE REGION BETWEEN THE RIVERS SAMBRE AND MEUSE,
Vrije Univ., Brussels (Belgium). Lab. voor Algemene Plantkunde en Natuurbeheer.
J. Symoens, L. Deronde, F. V. Mynsbrugge, and P. Van Geit.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 928-933, 1 fig, 3 tab, 6 ref.

Descriptors: *Limnology, *Etang des Monts Roses(Belgium), *Etang du Gland(Belgium), *Phytoplankton, *Land use, *Lithology, *History, Geology, Lakes, Belgium, Chemical properties, Watersheds(Basins), Lake morphology, Transparency, Light penetration, Algae, Periphyton, Benthic flora, Primary productivity, Biomass, Eutrophication, Diatoms, Chrysophyta, Cyanophyta, Desmids.

Recent limnological comparison of two small premodern man-made Belgian lakes, Etang des Monts Roses (first mentioned in 1755) and Etang du Gland (created about 1540), located in a region of remarkable geological and lithological diversity south of the depression formed by the Rivers Sambre and Meuse, showed that differences in limnology originally due to lithological contrasts have been reinforced by different land use. These findings contradict the hypothesis that water bodies, especially small ones, in densely populated regions of western Europe tend to evolve toward a uniform state through general eutrophication. Mont Roses has a watershed of psammites and schists, with some macigno (a sandstone rich in calcium). The basin is covered 93% by pastures, 5% by forest, and 2% by settlements. Gland has a

catchment of phyllites and quartzites, and is covered 65% by forest, 30% by agriculture, and 5% by pastures; there are practically no houses. Transparency was 45-120 cm in Monts Roses and 80 cm to the bottom (about 250 cm) in Gland. Phytoplankton in Monts Roses were dominated by diatoms in winter and spring, the cyanophyte Microcystis aeruginosa was abundant from April on, and Chlorococcales developed in May. Desmids were scarce all year. In Gland net plankton included Chrysophyceae and diatoms; the diatom Rhizosolenia longiseta was abundant in October, and Surirella robusta var. splendida from October to May. Desmidiaceae were diverse, Chlorococcales always present, and cyanophytes insignificant. Periphyton and benthic flora are also described. (Lynch-Wisconsin)
W79-08969

ROLE OF THE LITTORAL VEGETATION IN THE PHOSPHORUS AND NITROGEN BALANCE OF THE LAKE DRONTERMEER,
Ijsselmeerpolders Development Authority, Lelystad (Netherlands).
M. Loenen, and A. H. Koridon.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 935-938, 8 ref.

Descriptors: *Lake Drontermeer(Netherlands), *Littoral, *Phosphorus, *Nitrogen,*Eutrophication, *Phragmites australis, *Nutrient balance, Harvesting, Reed, Lakes, Netherlands, Nutrients, Nutrient loading, Water pollution effects, Water pollution control.

Littoral vegetation of Lake Drontermeer, Netherlands, dominated by common reed (Phragmites australis) plays a very small role in the lake's phosphorus and nitrogen balance, with less than 1% of the annual load either removed by harvesting half of the reed for thatching, or stored in newly formed underground parts. Present management of littoral vegetation through winter harvesting therefore does not contribute to nutrient removal and does not improve water quality in the eutrophic lake. Removal of 1.5-3.0% of the phosphorus load and 3.6% of the nitrogen load would be possible by harvesting all the littoral vegetation in August when nutrient content is maximum, but this alternative is impractical. Such harvesting would remove 900 kg P and 8700 kg N from the 49-ha littoral zone. Calculations were based on data collected 1975-76 in the lake, which was separated from Lake Ijsselmeer in 1957 during construction of the Flevopolders, and which became eutrophic after 1965. There is no strong correlation between nutrient accumulation in Phragmites and ambient nutrient levels. The vegetated area increased from 43 ha in 1962 to 49 ha in 1972. Nutrient load to the lake 1962-72 was estimated at 5-10 g P/sq m/yr and 25-50 g N/sq m/yr. Current load is estimated at 28,000-57,000 kg P/yr, and 143,000-286,500 kg N/yr. (Lynch-Wisconsin)
W79-08970

CHARACTERIZATION OF SPECIES DIVERSITY OF PHYTOPLANKTON ASSEMBLAGES BY DOMINANCE-DIVERSITY CURVES,
Amsterdam Univ. (Netherlands). Limnological Lab.
G. M. Hallegraeff, and J. Ringelberg.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 939-949, 4 fig, 1 tab, 25 ref.

Descriptors: *Netherlands, *Species diversity, *Phytoplankton, *Dominance-diversity curves, *Mathematical studies, *Analytical techniques, Dominant organisms, Algae, Diversity indices, Methodology, Abundance, Species evenness, Species richness, Hydrology, Trophic level, Eutrophication, Bioindicators, Oligotrophy, Niches, Ecology, Ponds, Lakes, Rivers, Barlosche Kolk(Netherlands), Pool 't Hammetje(Netherlands), Lake Maarsseveen(Netherlands), Rhine River, Bizonbaai(Netherlands), Viswater(Netherlands), Uiversnest(Netherlands), Meeuwenven(Netherlands).

Phytoplankton records from eight bodies of water in the Netherlands were used to construct dominance-diversity curves, permitting a detailed graphic description of the complete species-abundance sequence. Curves were plotted according to Whittaker (1965), with relative abundance as percentages on a log-scale on the ordinate and rank of the species, arranged in a sequence from most to least important, on a linear abscissa. Species richness (number of species) is indicated on the abscissa, and spicies evenness (with which importance is divided among species) is given by the curve's slope. Species diversity was studied by analyzing form and slope of the curves. Conclusions: (1) unitary mathematical characterization of the curves was not possible because of a wide variation of forms and slopes, ranging from geometric series through log-normal distributions to broken-stick distributions; (2) slopes for eutrophic waters generally showed greater annual variation than oligotrophic waters; (3) in floristically poor, rigorous environments (moorland pools, large stream) curves were steeply oblique, approximating geometric series; and (4) in species-rich, eutrophic environments curves were flat-sigmoid with long intermediate segments. The water bodies, covering a great range of hydrological and trophic conditions, included moorland pools (Universnest, Meeuwenven), shallow (Pool 't Hammetje, Viswater) and deep (Lake Maarsseveen) sandpits, a river dikeburst pool (Barlosche Kolk), and a sandpit (Bisonbaai) and branch (Lek) of the Rhine River. (Lynch-Wisconsin)
W79-08971

VERTICAL CHANGES IN THE FILTERING, FEEDING AND ASSIMILATION RATES OF DOMINANT ZOOPLANKTERS IN A STRATIFIED LAKE,
Hydrobiologischo Inst., Nieuwersluis (Netherlands).
R. D. Gulati.
In: Proceedings: 20th Congress; Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 950-956, 2 fig, 3 tab, 16 ref.

Descriptors: *Zooplankton, *Feeding rates, *Depth, *Filter feeders, *Lake Vechten(Netherlands), *Seasonal, *Vertical distribution, Crustaceans, Dominant organisms, Lakes, Stratification, Sand pits, Diaphanosoma brachyrum, Daphnia hyalina, Daphnia cucullata, Bosmina longirostris, Ceriodaphnia pulchella, Eudiaptomus gracilis, Phytoplankton, Algae, Chlorophyta, Chlorella pyrenoidosa, Food habits, Biological communities, Grazing, Cladocera, Copepods, Netherlands, Seston.

Vertical and seasonal changes in feeding and assimilation rates of dominant crustacean filter feeding zooplankters were studied in a small, stratified sand-pit lake, Lake Vechten, Netherlands. Maximum depth is 11.5 m, mean depth six m. The six dominant species were the cladocerans Daphnia cucullata, D. hyalina, Bosmina longirostris, Diaphanosoma brachyurum, and Ceriodaphnia pulchella, and the calanoid copepod Eudiaptomus gracilis. Food concentration (mainly Chlorella pyrenoidosa) during the study year, 1976, was highest at the end of March (six g C/sq m) and relatively homogeneous with depth. At that time zooplankton biomass was low (0.5 g C/sq m), likewise exhibited no vertical differences, and was composed mainly of Eudiaptomus. Zooplankton concentration increased to two g C/sq m by 11 May, due mainly to increases in the upper strata of Eudiaptomus, Daphnia, and Bosmina; food concentration declined by over 50% and by 25 May dropped to a level at which zooplankton biomass was comparable to its seston food. During late spring-early summer grazing pressure appeared important in governing the decline in food concentrations in the upper layers; food level then was almost the lowest of the year, despite relatively high production rates. Summer data show that differences in depth distribution of seston food were not significant; but those of zooplankton were, and that zooplankton/food biomass ratios during summer increased significantly with depth. Species' grazing rates, filtering and feeding rates, and role in the community are discussed. (Lynch-Wisconsin)
W79-08972

BULLETIN OF GASES FROM SEDIMENT, CONDITIONS, AND RELATIONSHIP TO PRIMARY PRODUCTION OF LAKES,
Max-Planck-Inst. fuer Limnologie zu Ploen (West Germany).
W. Ohle.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. part 2, p 957-962, 8 fig, 1 tab, 7 ref.

Descriptors: *Lakes, *Primary productivity, *Sediments, *Ebullition, *Bacteria, *Degradation(Decomposition), *Mud-water interfaces, Methane, Carbon dioxide, Hydrogen sulfide, Fatty acids, Gases, Oxidation, Hemmelsdorf Lake(West Germany), Pluss Lake(West Germany), Grebin Lake(West Germany), West Germany, Metabolism, Hydrogen, Nitrogen, Mud, Nitrification, Denitrification, Lake morphometry.

Ebullition of gases (mainly methane and carbon dioxide) as a result of bacterial fermentation processes in lake sediments is extremely dependent on phytoplankton production. Autochthonous productivity and bioactivity, together with morphometric conditions of the body of water, strongly affect the quantity of such mud gases and variability of their oxidation rates. This paper discusses fermentation at the mud-water interface, and gives data from Hemmelsdorf, Pluss, and Grebin Lakes (West Germany) to illustrate effects of primary production by phytoplankton. The bacterial processes are based on splitting of fatty acids as well as reduction of carbon dioxide by hydrogen (both gases produced by the breakdown of the fatty acids). Favorable conditions exist in sediments for fermentation leading to methane formation, and for high decomposition rates of organic substances. A direct relationship exists between sulfate ion supply and formation of hydrogen sulfide in the mud; methanogenesis and denitrification are inhibited by H2S and SH(-) if not strongly bound by iron compounds. In Hemmelsdorf Lake 1% of primary production is sedimented, and for anaerobic decomposition about 50% of the preliminary remains are used. In Pluss Lake only 0.5% of primary products are sedimented, and in Grebin Lake 1.0% are sedimented. (Lynch-Wisconsin)
W79-08973

SPECIFICITY OF THE ZOOPLANKTON IN SEVERAL LAKES FROM NORTHERN GERMANY WITH DIFFERENT DEGREE OF EUTROPHICATION,
Institutul de Stiinte Biologice, Bucharest (Romania).
S. P. Godeanu.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 963-968, 3 fig, 3 ref.

Descriptors: *Eutrophication, *Lakes, *West Germany, *Zooplankton, *Bioindicators, *Trophic level, Water quality indices, Kellersee(West Germany), Gr Ploner See(West Germany), Schohsee(West Germany), Abundance, Rotifers, Protozoa, Copepods, Cladocera, Biomass, Species diversity, Diversity indices, Dominant organisms, Species evenness.

Zooplankton composition was a reliable indicator of trophic level in three West German lakes, based on 1974 data. The three lakes, located on the southern edge of the zone of glacial moraines, evolved similarly until affected by recent pollution. Lake Kellersee is the most eutrophic; Lake Gross Ploner See, 15/km downstream on the Schwentine River from Kellersee, is slightly eutrophic; and Lake Schohsee, unconnected to the other two, has no sources of pollution and is mesotrophic-eutro-

phic. Kellersee always possesses a great number of zooplankton and a rich biomass, with maxima in May, July, and August; of 103 taxa, 27 are always present, 16 are incidental, and 60 are occasional. Mean dominance index value is 46.8% (McNaughton index), Shannon-Wiener diversity index is 3.16 bits/ind, and equitability index is 0.63. Lake Gross Ploner See is characterized in number and biomass by intermediate zooplankters, compared with the other lakes. Cladocerans and protozoa are abundant in spring and summer, and copepods are reduced in April and in August-September. Of 105 taxa, 24 are constant, 16 incidental, and 65 occasional. Average index values are 52% dominance, 3.04 bits/ind diversity, and 0.60 equitability. Lake Schohsee has a great increase in tintinnoids in spring, while during the rest of the year only rotifers are dominant with copepods poorly represented. Of 102 taxa, 24 are constant, 9 incidental, and 69 accidental. Mean index values are 57.6% dominance, 2.82 bits/ind diversity, and 0.57 equitability. (Lynch-Wisconsin)
W79-08974

CLIMATIC CONDITIONS AND PLANKTONIC INTERACTIONS AS FACTORS CONTROLLING THE REGULAR SUCCESSION OF SPRING ALGAL BLOOM AND EXTREMELY CLEAR WATER IN LAKE CONSTANCE,
Frankfurt Univ. (Germany, F.R.). Fachbereich Biologie.
W. Lampert.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September, 1978. Part 2, p 969-974, 4 fig, 8 ref.

Descriptors: *Lake Constance, West Germany, *Transparency, *Eutrophication, *Phytoplankton, *Succession, *Zooplankton, *Climate, Weather, Secchi disks, Temperate, Lakes, Algae, Chlorophyll, Primary productivity, Water temperature, Stratification, Phosphates, Solar radiation, Photoperiodism, Stephanodiscus hantzschii, Cryptomonas, Flagellates, Cyclops vicinus, Daphnia, Eudiaptomus gracilis, Grazing, Ecology, Predation, Limiting factors, Competition, Biological communities.

The annual sequence of spring algal bloom followed by a sudden increase in transparency in Lake Constance, on the borders between Germany and Austria, and Switzerland, depends on complex interactions between nutrient levels and amount of irradiance and grazing-predation by the zooplankters Cyclops vicinus and Daphnia sp. Under study April-July 1976 the bloom of Stephanodiscus hantzschii, Cryptomonas, and small flagellates was triggered in mid-May by high phosphate levels and strong irradiance, accompanied by a decline in transparency to under one meter and sharp peaks of chlorophyll-a and particulate carbon. During the bloom hertivorous Cyclops copepodids were the primary grazers, but consumed only 20% of net primary production. The greater herbivores, the Daphnids, were apparently controlled during the bloom by predation of adult Cyclops, which die off when the copepodids reach the fourth growth stage and are triggered into summer diapause by increasing day length, disappearing into the sediment. Daphnids, relieved of predatory pressure, increase rapidly, sometimes consuming more than the total primary production per day. The increased grazing by Daphnia and coincident phosphorus depletion ends the bloom, and transparency at the beginning of June may increase to over 10 meters in just a few days. A shift in the algal community's size composition also occurs, and by the end of June large algae make up a significant part of the primary production. (Lynch-Wisconsin)
W79-08975

NUTRIENT LOAD AND NUTRIENT BALANCE OF SOME SUBALPINE LAKES AFTER SEWAGE DIVERSION,
Bayerische Landesanstalt fuer Wasserforschung, Munich (Germany, F.R.).
A. Hamm.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 975-984, 4 fig, 4 tab, 10 ref.

Descriptors: *Nutrient loading, *Nutrient balance, *Lake restoration, *Lake Tegernsee(West Germany), *Lake Schliersee(West Germany), *Diversion,*Eutrophication, *Trophic level, Sewage disposal, Water pollution control, Nutrients, Phosphorus, Nitrogen, Lakes, West Germany, Subalpine, Vollenweider models, Sedimentation, Limnology, Climate, Oxygen depletion, Transparency, Water pollution effects.

Large-scale sewage diversion projects completed 1964-65 restored highly eutrophic Lake Tegernsee (upper Bavaria, West Germany) to oligotrophic conditions by 1973-74, but eutrophic conditions persisted in adjacent Lake Schliersee. A study of nutrient loading and nutrient balance showed that in Tegernsee the critical phosphorus loading (calculated with Vollenweider's 1976 formula was achieved by 1974, while it was not achieved in Schliersee. Contrary to previous conclusions, however, the continuing high phosphorus levels were not due to internal loading, but due rather to remaining allochthonous nutrient inputs. Nutrient balance was not significantly affected by nutrient remobilization. Removal of the last sewage inflows is in progress, and permanent water quality improvement is expected. The critical phosphorus loading for Tegernsee is calculated at 0.57 g/sq m/a, not fully reached by 1973 (1.06 g), but achieved by 1974 (0.54 g). In Schliersee the critical phosphorus load of 0.30 g/sq m/a was not reached in either 1973 (0.51 g) or 1974 (0.59 g), reflected in its continuing eutrophic characteristics. In Tegernsee, progressive improvement has been observed: (1) minimum metalimnetic oxygen levels have increased from 3.1 mg/l in 1964 to 8.3 mg/l in 1976; (2) late summer anaerobic conditions below 65 m have occurred only once in recent years (1969), and bottom oxygen content is currently never less than 4.1 mg/l; (3) transparency has improved; and (4) formerly typical Oscillatoria rubescens blooms have disappeared. (Lynch-Wisconsin)
W79-08976

ROLE OF SESTON IN THE PHOSPHATE REMOVAL IN NEUSIEDLER SEE,
Vienna Univ. (Austria). Limnologische Lehrkanzel.
A. Gunatilaka.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 986-991, 2 fig, 4 tab, 17 ref.

Descriptors: *Neusiedler See(Austria), *Seston, *Phosphates, *Nutrient removal, *Suspended solids, *Kinetics, *Absorption, Lakes, Austria, Nutrients, Chemical precipitation, Calcium carbonate, Iron hydroxide, Inorganic compounds, Orthophosphate.

Sestonic material had strong affinity for binding phosphates in the Neusiedler See, a large shallow lake in eastern Austria, during studies conducted since 1970. The lake water contained relatively high amounts of suspended material, 79-90% of which by dry weight was inorganic. Sestonic material collected during summer 1976-77 had as major mineralogical constituents (mean percent) calcite (37%), dolomite (22%), illite (19%), chlorite (11%), quartz (10%), and K-feldspar (3%). Water samples varied greatly in suspended solids (15.5-247.8 mg/l) and chlorophyll (7.6-24.4 microg/sq m) levels. Phosphate uptake patterns were observed in laboratory experiments, in 83% of which there was complete depletion of dissolved phosphates. Uptake was proportional to suspended solids concentration, verified by radiological assays. In 76% of the tests uptake started at the beginning of the experiment, but in the rest there was a lag phase of 10-20 hrs, and in 8% of these orthophosphate in solution increased 6-17 microg/l during the lag phase. Patterns fit first-order kinetic reactions better than second-order, showing that the process was governed by the amount of reactant present and that uptake depended on the availability of absorbate in solution. It is probable that a larger part of the phosphate is absorbed by the inorganic fraction of the suspended solids. This process may be explained by either: (1) co-precipitation of phosphate by calcium carbonate absorption or formation of mixed crystals, or (2) precipitation by colloidal iron hydroxide. (Lynch-Wisconsin)
W79-08977

VALUE OF SOME BIOLOGICAL INDICES IN CASE HISTORIES OF LAKES,
Nicholas Copernicus Univ. of Torun (Poland). Dept. of Hydrobiology.
J. S. Mikulski.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 992-996, 3 fig, 13 ref.

Descriptors: *Eutrophication, *Bioindicators, *Paleolimnology, *Goplo Lake(Poland), *Zooplankton, *Lakes, *Water quality indices, Evaluation, Limnology, History, Sediments, Sedimentation, Lake morphology, Water level fluctuations, Cladocera, Ecology, Species diversity, Species evenness, Poland, Bosmina coregoni, Bosmina longirostris, Chydorus sphaericus, Littoral, Water pollution effects, Biocoenosis, Periphyton, Macrophytes.

Several indices are for tracing the ecological history of lakes, particularly progressive eutrophication are evaluated. Subfossil animal remnants in sediments are useful bioindicators, as indicated by sediment samples from Goplo Lake, northern Poland. Indices are: (1) index of eutrophication (IE), based on the quantitative relationship between Bosmina coregoni and Chydorus sphaericus; (2) index of lake level oscillation (ILL), reflecting influence of such fluctuations on the relationship between pelagic and littoral zones; (3) index of lake shape regularity (ILSR), which considers effects of sedimentation and water level changes on the relationship of surface area to depth; (4) percentage relationship between Chydoridae and macrophyte formation; and (5) species diversity vs species equitability. The assumed replacement of B. coregoni by B. longirostris with increasing eutrophication applies mostly to lakes with harmonic development, unlike Goplo Lake. C. sphaericus, a littoral species, penetrates the pelagic zone with development of strong algal blooms (mainly cyanophytes). This study confirmed the relationships ILL = Bosminidae + Daphnidae/Chydoridae, and ILSR = B. coregoni + Chydoridae lacustrinae/all preserved cladoceran remains. Chydoridae connected with (1) reed periphyton (dominated by Along offinis), and (2) macrophyte groupings (dominated by Acroperus harpae, Grapholeberis testudinaria, and Eurycercus lamellatus) decreased with progressive eutrophication, and can be used as indices of littoral variations. (Lynch-Wisconsin)
W79-08978

SIGNIFICANCE OF BENTHAL FAUNA AS INDICATOR OF EUTROPHICATION DEGREE IN LAKES,
Nicholas Copernicus Univ. of Torum (Poland). Dept. of Hydrobiology.
A. Gizinski.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 997-999, 3 ref.

Descriptors: *Eutrophication, *Bioindicators, *Poland, *Lake Jeziorak(Poland), *Lake Jeziorak Maly(Poland), *Benthic fauna, *Water mass, *Water quality indices, *Trophic level, Ecology, Water pollution effects, Byszewskie Channel(Poland), Species composition, Abundance, Species richness, Equations, Potamopyrgus jenkinsi, Glyptotendipes gripekoveni, Bathophilus, Tanytarsus gregarius, Dissolved oxygen, Profundal zone, Lakes, Chironomus plumosus.

Studies in 13 lakes in northern Poland showed that the abundance of profundal fauna and its composition are useful indicators of trophic status among

lakes having similar water mass mobility. An index of mixing (1M) is proposed for water mass dynamics based on 11 lakes of the Byszewskie Channel: 1M = 4.4 sq root of wave run length/mean basin depth. These lakes are moderately eutrophic, of the Bathophilus (Anthracinus type), and are similar hydrochemically but differ morphometrically. Only the profundal fauna was studied. The other two study lakes were strongly eutrophic Jeziorak and Jeziorak Maly, near Ilawa, both having very poor profundal fauna. Jeziorak Maly is more strongly degraded than Jeziorak. The number of benthic fauna taxa was lower in Jeziorak Maly (30) than in Jeziorak (36). Larvae of Tanytarsus e.g. gregarius were numerous in the Jeziorak littoral, but were absent in Jeziorak Maly. In the latter the snail Potamopyrgus jenkinsi, abundant in 1974-75, has now disappeared, but is likewise absent from Jeziorak. In Jeziorak Maly, Glyptotendipes e.g. gripekoveni larvae formed 59% of the midge population, compared with 42% in Jeziorak. Mean number of individuals/sq m of bottom fauna was 3410 in Jeziorak Maly and 2662 in Jeziorak, and seasonal change in abundance was greater in Jeziorak Maly (766-4797 vs 1108-4686). Low dissolved oxygen in the profundal zone results in very low faunal abundance and reduced number of species. (Lynch-Wisconsin)
W79-08979

CHANGES OF THE DISTRIBUTION AND NUMBER OF THE BOTTOM FAUNA AS AN EFFECT OF ARTIFICIAL LAKE AERATION,
Polish Academy of Sciences, Olsztyn.
A. Sikorowa.
In: Proceedings: 20th Congress, International Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1000-1003, 3 fig, 8 ref.

Descriptors: *Aeration, *Destratification, *Lake Starodworskie(Poland), *Benthic fauna, *Spatial distribution, *Abundance, *Eutrophication, *Lake restoration, Lakes, Poland, Vertical distribution, Depth, Chironomidae, Oligochaetes, Chaoborus flavicans, Fish stocking, Nutrient removal, Littoral, Stratification, Dissolved oxygen, Habitats, Hypolimnion, Heleidae, Hydracarinae, Profundal zone.

Destratification by means of artificial aeration of eutrophic Lake Starodworskie in northeastern Poland resulted in favorable effects on benthic fauna. Numbers and distribution of most organisms were increased in zones previously covered by the hypolimnion. The only exception was larvae of the midge Chaoborus flavicans, whose habitat area decreased. Before aeration vertical distribution of fauna was generally restricted to a depth of 5-10 m; at 15 m only C. flavicans larvae plus one or two occurrences of Oligochaeta and Heleidae were found, and at 23 m only C. flavicans was found. By the end of the aeration period (March 1972 - September 1973) these areas were occupied by numerous Chironomidae, Oligochaeta, Hydracarinae, and Heleidae. Average monthly abundance reached a maximum of 44,327 indiv/sq m at 10 m, but increases were noted in all zones. In the littoral total number increased over five-fold, in the sublittoral three-fold, at 10-m 18-fold, at 15 m 10-fold, and at 23 m 2.5-fold. A higher rate of increase among Oligochaeta compared to Chironomidae may have been due to stronger fish predation upon the latter. Beneficial effects of aeration could be augmented through a program of fish stocking and subsequent exploitation, thus providing both nutrient removal and a protein supply. Chironomidae best illustrate the general quantitative and spatial improvement, reaching 4654-4847 indiv/sq m in the deepest zone, compared with zero before aeration. (Lynch-Wisconsin)
W79-08980

CONTRIBUTION OF FISH AND INVERTEBRATE PREDATION TO THE ELIMINATION OF ZOOPLANKTON BIOMASS IN TWO POLISH LAKES,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
Z. M. Gliwicz, A. Hillbricht-Ilkowsks, and T. Weglenska.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1007-1011, 3 fig, 7 ref.

Descriptors: *Mikolajskie Lake(Poland), *Lake Taltowisko(Poland), *Zooplankton, *Invertebrates, *Fish, *Predation, Biomass, Fish food organisms, Poland, Lakes, Seasonal, Feeding rates, Planktivores, Rotifers, Crustaceans, Copepods, Asplanchna priodonta, Leptodora kindti, Mesocyclops leuckarti, Chaoborus flavicans, Alburnus alburnus, Osmerus eperlanus, Coregonus albula, Cladocera.

Seasonal changes in zooplankton biomass elimination and consumption by fish and invertebrates were compared in eutrophic Mikolajskie Lake and mesotrophic Lake Taltowisko in Poland, with data from 1966 and 1968. In both lakes the predatory cladoceran Leptodora kindti consumed the largest portion of biomass waste. Seasonal changes in its consumption coincided most highly with changes in zooplankton biomass elimination (especially crustaceans); this predator is most important in summer. In spring (May) in Mikolajskie Lake, cyclopoid copepods, mostly Mesocyclops leuckarti, consumed the largest portion of waste (almost exclusively copepods and rotifers), while in autumn when rotifers were largely absent, the predatory rotifer Asplanchna priodonta and larvae of the midge Chaoborus flavicans played a more important role. The pattern in Lake Taltowisko was similar, though consumption by cyclopoid copepods was highest in June, and by Asplachna in September; Chaoborus was unimportant. The planktivorous fish Coregonus albula, Osmerus eperlanus, and Alburnus alburnus, consumed negligible amounts of the zooplankton biomass compared with invertebrate predators, with their share of total predator consumption relatively high only at the beginning of July in both lakes. Absolute values of elimination and consumption generally coincided seasonally in the two lakes, especially in Mikolajskie, though in Taltowisko elimination was higher than consumption throughout the year, possibly due to estimating errors. (Lynch-Wisconsin)
W79-08981

RELATIONSHIP BETWEEN THE SURFACE WATER TEMPERATURE OF TEMPERATE LAKES AND SOLAR RADIATION,
Polish Academy of Sciences, Golysz Fish Culture Station.
M. A. Szumiec.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978, Part 2, p 1012-1016. 2 fig, 1 tab, 3 ref.

Descriptors: *Solar radiation, *Temperate, *Poland, *England, *Lakes, *Water temperature, Surface waters, Mathematical studies, Heat transfer, Heat balance, Seasonal, Climate, Lake morphology, Depth, Stratification, Hypolimnion, Hydrology, Lake morphometry, Heat flow.

Data for several temperate dimictic English and Polish lakes were used to study the seasonal relationship between surface water temperature and solar radiation. The lakes differed mainly in the predominantly oceanic (English lakes) or continental (Polish lakes) nature of the local climate. The yearly water temperature (v) cycle, presented as a dependence on solar radiation flux (R), took the form of an ellipse for the study lakes. The function v(R) permits estimation of the intensity of remaining components of the water body's heat balance during specific periods of the year. The surface of the ellipse, which gives the yearly heat flux through the surface layer, increased in size with increasing influence of the continental regime and with increasing lake volume. Temperature below the thermocline depends mainly on lake hydromechanics, and is affected only indirectly by solar radiation; consequently v(R) curves for these water layers are more irregular than in shallow reservoirs or ponds. The ellipses show that in January-February there is increasing radiation but falling water temperatures, indicating that heat outflux from the lakes exceeds absorbed radiation. March-May v and R increase simultaneously, while in June diminished R increase is accompanied by intensive v increase. V continues to rise in July despite declining R, indicating an intensive heat flux to the lake resulting from lake heat processes. August-October shows a decline in both v and R, and in November an intensive heat outflux begins. (Lynch-Wisconsin)
W79-08982

DYNAMICS OF PRODUCTION OF THE PELAGIC ROTIFERS IN THREE LAKES OF DIFFERENT TROPHISM,
Akademia Rolnicza, Lublin (Poland). Zaklad Zologii and Hydrobiologii.
S. Radwan.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1017-1021. 2 fig, 10 ref.

Descriptors: *Population dynamics, *Rotifers, *Production, *Piaseczno Lake(Poland), *Bikcze Lake(Poland), *Trophic level, Zooplankton, Phytoplankton, Algae, Species composition, Poland, Lakes, Eutrophication, Mesotrophy, Dystrophy, Asplanchna priodonta, Kellicottia longispina, Keratella cochlearis, Keratella cochlearis hispida, Polyarthra vulgaris, Synchaeta pectinata, Nonnoplankton, Seasonal, Bacteria, Detritus, Food habits.

Daily production of pelagic rotifers was higher in eutrophic, polymictic Bikcze Lake than in a-mesotrophic, dimictic Piaseczno Lake or dystrophic, polymictic Brzeziczno Lake (Poland), 1971-72 and 1974. Production was lower in the latter two lakes, determined by slight differences in species composition. Trophic status has been shown to affect the proportion of nannoplankton in the rotifer diet. In eutrophic lakes where nannoplankton form a small percent of total algal biomass, high rotifer production probably depends greatly on consumption of bacterial plankton and minute detritus, whereas in lakes of other trophic levels where rotifers are less abundant the percentage share of nannoplankton in their food increases. In the lakes investigated, three rotifer species accounted for most of total production (10-100%): Asplanchna priodonta, Keratella cochlearis, and Polyarthra vulgaris. A. priodonta was the most important species in spring in all three lakes (except Brzeziczno Lake in 1971), with 63-97% of production. K. cochlearis was responsible for 68-100% of production in Piaseczno and Brzeziczno Lakes in summer-autumn and early spring. P. vulgaris was important in Bikcze Lake in early spring and summer. Keratella cochlearis hispida, Kellicottia longispina, and Synchaeta pectinata influenced production only slightly, rarely exceeding 10% of production except in the a-mesotrophic and dystrophic lakes. (Lynch-Wisconsin)
W79-08983

ESTIMATION OF THE ROLE OF ZOOPLANKTON IN THE PROCESSES OF SELFPURIFICATION,
Akademiya Nauk SSSR, Leningrad. Inst. Ozerovedeniya.
I. Andronikova.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1022-1025. 1 fig, 2 tab, 8 ref.

Descriptors: *Self-purification, *Zooplankton, *Crustaceans, *Lake Krasnoye(U.S.S.R.), *Mesotrophy, *Organic matter, Cladocera, Copepods, Soviet Union, Lakes, Seasonal, Littoral, Offshore zone, Secondary production, Filter feeders, Daphnia longispina, Daphnia cucullata, Diaphanosoma brachyurum, Chydorus sphaericus, Eudiaptomus gracilis, Mesocyclops leuckarti, Mesocyclops oithonoides.

Zooplankton contribution to self-purification in mesotrophic Lake Krasnoye, Soviet Union, based on estimates for crustacean filter feeders in 1973, were sharply seasonal, with greatest activity in

July-August when zooplankton filtered the lake volume in an average of three days, and the upper 0-2 m layer in 1.0-1.5 days. In summer the pelagic zone was filtered an average of five days and the littoral in two days. Filtration decreased sharply in September, and in October it was insignificant. These figures were estimated on the basis of the filtration rate of Cladocera and Copepoda, and the seasonal pattern presented therefore probably exaggerates the summer peak because Protozoa and Rotatoa which attain maximum development in spring and autumn also contribute to self-purification. Since winter production of zooplankton is only 4% of annual production, however, the role of zooplankton in self-purification during winter is negligible. In the period May-October zooplankton removed over 7000 tons suspended organic matter from the water masses, of which 42% was mineralized. The intensity of zooplankton purifying activity is considerably higher in the littoral than in offshore waters; the littoral is thus an ecological barrier to anthropogenic inputs to the lake. Dominant filter feeders in 1973 were Daphnia longispina, D. cucullata, Diaphanosoma brachyurum, Chydorus sphaericus, and Eudiaptomus gracilis; earlier instars of Mesocyclops leuckarti and M. oithonoides were also considered. (Lynch-Wisconsin)
W79-08984

COMPARATIVE VERTICAL ZONATION AND DIURNAL MIGRATION AMONG CRUSTACEA AND ROTIFERA IN THE SMALL HIGH MOUNTAIN LAKE LA CALDERA (GRENADA, SPAIN),
Granada Univ. (Spain). Dept. of Ecology.
L. Cruz-Pizarro.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1026-1032. 3 fig, 2 tab, 11 ref.

Descriptors: *La Caldera Lake(Spain), *Vertical distribution, *Zonation, *Diel migration, *Crustaceans, *Rotifers, Lakes, Spain, Mountain lakes, Depth, Copepods, Cladocera, Biorhythms, Zooplankton, Copepodids, Nauplii, Oligotrophy, Mixodiaptomus laciniatus atlantis, Daphnia pulex, Chydorus sphaericus, Hexarthra bulgarica, Keratella cochlearis, Euchlanis.

Vertical zonation and diurnal migration of six zooplankton species were studied in August and September in La Caldera Lake, an unproductive, transparent, high mountain lake on the southern slope of the Sierra Nevada, Granada, Spain. The most significant species were the crustaceans Mixodiaptomus laciniatus atlantis, Daphnia pulex, and Chydorus sphaericus, and the rotifers Hexarthra cf. bulgarica, Keratella cochlearis, and Euchlanis sp. For the copepod Mixodiaptomus, diurnal migration was studied separately for nauplii, copepodids, and adults, and for males and females. Results showed that: (1) Mixodiaptomus migrated upward at night, with some differences by growth stage and gender; (2) the cladocerans Daphnia and Chydorus were found in deepest layers during the day, migrating upward at night but with an upper maximum reached later than Mixodiaptomus (four a.m. vs midnight); and (3) striking differences were found among rotifers, with Hexarthra showing a typical upward nocturnal migration, Keratella showing a notable tendency toward upward migration at midday and random distribution at night, and Euchlanis, exhibited a definite upward nocturnal migration, but was generally confined to the layer below seven m. Distribution of each species or copepod subdivision is presented in figures by depth and at two-hour intervals. It is noted that there have been objections to categorizing certain crustacean species as planktonic, even when collected in the limnetic zone. (Lynch-Wisconsin)
W79-08985

PHOSPHORUS, NITROGEN AND SILICA BUDGET IN LAGO DI MERGOZZO,
Istituto Italiano di Idrobiologia, Pallanza (Italy).
A. Calderoni, R. Mosello, and G. Tartari.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1033-1037. 2 fig, 4 tab, 11 ref.

Descriptors: *Phosphorus, *Nitrogen, *Silica, *Nutrient budgets, *Lago di Mergozzo(Italy), *Lake restoration, Dams, Lakes, Italy, Nutrients, Eutrophication, Mesotrophy, Vollenweider models, Trophic level, Hydraulic residence time, Hydrology, Silicon, Ammonia, Phosphates, Nutrient loading.

Phosphorus, nitrogen and silica budgets are given for Lago di Mergozzo, a deep monomictic lake in northern Italy, based on data for 1975. The critical loading level of phosphorus, which limits algal productivity in the lake, was calculated at 0.30 g/sq m/yr with Vollenweider's equations, which compares with a measured load of 0.53 g/sq m/yr. The lake is classified as mesotrophic. Eutrophic conditions observed 1969-72 are reversing, possibly due to shorter hydraulic residence time (4.7 yrs in 1975 vs 7.6 yrs 1971-74). Enrichment resulted from new sewage discharges in 1969 plus a temporary decrease in flushing rate because of construction of a new higher dam on the channel between the lake and Lago Maggiore. Nutrient inputs, outputs, and net load in g/sq m/yr for 1975 were: (1) silica-silicon 35.5, 4.6, and 30.9; (2) ammonia-nitrogen 3.01, 0.27, and 2.74; (3) nitrate-nitrogen 5.99, 5.10, and 0.89; (4) inorganic nitrogen 9.06, 5.41, and 3.65; (5) phosphate-phosphorus 0.36, 0.01, and 0.35; and (6) total phosphorus 0.53, 0.06, and 0.47. The village of Mergozzo contributed input of 8.8 g N/person/day and two g total P/person/day; phosphorus inputs came mainly (87.7%) from urban sewage. Natural watersheds contributed seven mg total P/sq m/yr. Rainwater contributed 25.6% of the inorganic nitrogen load, and natural watersheds about 45% of the total. There are no industries in the basin, and inputs from fertilizers or animal wastes are negligible. (Lynch-Wisconsin)
W79-08986

BACTERIAL ACTIVITY ON ORGANIC DETRITUS IN LAGO DI ANNONE, NORTHERN ITALY,
Istituto Italiano di Idrobiologia, Pallanza (Italy).
R. Bertoni, and C. Callieri.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1038-1044. 6 fig, 4 tab, 7 ref.

Descriptors: *Lago di Annone(Italy), *Bacteria, *Organic matter, *Detritus, *Particulate organic carbon, *Methodology, Degradation(Decomposition), Heterotrophy, Lakes, Italy, Ecology, Carbon, Measurement, Estimating, Biomass, Model studies, Regression analysis, Limiting factors, Water temperature, Fishkill, Alburnus alburnus alborella.

Heterotrophic bacterial activity can be measured by short-term variations in natural particulate organic carbon (POC) concentration and the relative increase of viable bacteria. The method is designed to overcome the major limitation of the standard approach (based on uptake kinetics of labelled organic substrates), namely that only one labelled substrate is used, which does not represent the complex pool of dissolved and particulate organic substances which constitutes natural detritus. The method was successfully applied to Lago di Annone, 50 km from Milan, composed of two small, shallow basins connected by a channel. Sampling was carried out April-October 1976. In Aug dead fish were removed, and the rest was incorporated into the organic detritus pool. Results showed that bacterial activity in the east basin depend upon temperature, and in the west basin upon availability of the of the particulate organic substrate. POC concentration is therefore a limiting factor of bacterial activity in this water body. POC was concentrated from samples on GF/C glass fiber filters 14 mm in diameter, precombusted at 500 C, and analyzed with a dry oxidation system, fitted with a gas chromatograph. Bacterial plate counts were made on casein-peptone-starch medium inoculated by spread plate techniques; colonies were counted after a 5-day incubation at 24 C. (Lynch-Wisconsin)
W79-08987

EFFECT OF MASS FISH MORTALITY ON ZOOPLANKTON STRUCTURE AND DYNAMICS IN A SMALL ITALIAN LAKE (LAGO DI ANNONE),
Istituto Italiano di Idrobiologia, Pallanza (Italy).
R. De Bernardi, and G. Giussani.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1045-1048. 3 fig, 7 ref.

Descriptors: *Fishkill, *Lago di Annone(Italy), *Zooplankton, *Daphnia hyalina, *Bosmina longirostris, *Population dynamics, Predation, Size, Selectivity, Alburnus alburnus alborella, Italy, Lakes, Cladocera, Fish diseases, Eutrophication, Ecology, Adaptation, Competition, Fish food organisms.

A major fishkill in August 1975 of Alburnus alburnus alborella, the most abundant planktophagous fish in the eastern basin of eutrophic Lago di Annone, northern Italy, resulted in an abrupt increase in the maximum size of its most important prey, the cladoceran Daphnia hyalina. A progressive increase in density of the size-selective Alburnus population 1954-75 had correspondingly decreased maximum Daphnia size from about 1450 micrometers to about 1000 micrometers; maximum size increased to about 1600 micrometers in 1976 after the fishkill. The western basin (connected to the eastern by a channel), was unaffected by the gill disease which caused the fish mortality; the Alburnus density there has remained fairly constant over the past 22 years at about the eastern basin's 1954 level; Daphnia maximum size also remained relatively constant at about 1400-1500 micrometers. Size-selective predation by Alburnus produced an adaptive reaction by Daphnia, especially in production of smaller sizes of primiparae. Ovigerous Daphnia of 630 micrometers were found during high fish density in the eastern basin, while in the western basin primiparae size never fell below 1000 micrometers. The fishkill caused a rapid increase in Daphnia density in the affected basin, followed by sudden breakdown due to food exhaustion (chlorophyll-a and particulate organic carbon). Bosmina longirostris abundance varied inversely with Daphnia abundance, demonstrating competition. (Lynch-Wisconsin)
W79-08988

ALTERATIONS OF THE PLANKTON IN A MUCH POLLUTED LAKE IN CENTRAL ITALY (LATIUM), THE VOLCANIC LAKE NEMI,
Stabilimento Ittiogenico, Rome (Italy).
E. Stella, L. Ferrero, and F. G. Margaritora.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1049-1054. 5 fig, 12 ref.

Descriptors: *Lake Nemi(Italy), *Water pollution effects, *Zooplankton, *Eutrophication, *Succession, *Species composition, Phytoplankton, Algae, Lakes, Italy, Fungi, Epizoites, Seasonal, Fishkill, Cyanophyta, Oscillatoria, Volcanoes, Rotifers, Copepods, Cladocera, Diversion, Cyclops abyssorum, Keratella cochlearis, Ceriodaphnia quadrangula, Eudiaptomus padanus etruscus, Macrocyclops albidus, Mesocyclops leuckarti, Leptodora kindtii.

Pollution since 1969 of volcanic Lake Nemi in central Italy by wastes from the villages of Nemi and Genzano (2500 residents), intensified by discharges from a 1000-bed hospital, has drasticly reduced water quality and altered the chemical and biological characteristics of the entire basin. The lake, located in a hollow with steeply sloping sides on which the villages are situated, is 1.67 sq km in area, and has a maximum depth of 31 m. Diversion of one of the Genzano discharges and that from the hospital in February 1976 has improved conditions somewhat, but plankton remain abnormal. Zooplankton studied 1975-77 show drastic changes in species composition and distribution compared with pre-1969 studies. with disappearance of ap-

proximately 27 species previously reported except Keratella quadrata, Ceriodaphnia quadrangula, and Eudiaptomus padanus etruscus; Macrocyclops albidus was replaced by Mesocyclops leuckarti. Populations showed high densities which varied seasonally, and often only one species was present (e.g., K. quadrata in March, Cyclops abyssorum in late April, and Leptodora kindtii in June). The diversions resulted in a more regular succession of species through reappearance of several phytoplanktonic food organisms, but many zooplankton species are covered with epizoic algae (Colacium, Characiopsis) which hamper movement, and there has been massive infection of phytoplankton and zooplankton by parasitic fungi. (Lynch-Wisconsin)
W79-08989

EUTROPHICATION MODEL FOR THE MIDDLE REACHES OF THE LOIRE (MODELE D'EUTROPHISATION DE LA LOIRE MOYENNE),
Echauffement et Pollution des Eaux, Ecologie Div., Chatou (France).
E. Chalon.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 189-198, June 1979. 7 fig, 7 ref.

Descriptors: *Eutrophication, *Model studies, *Rivers, *Ecosystems, Mathematical models, Foreign research, Water temperature, Streamflow, Phytoplankton, Zooplankton, Nutrients, Nitrogen, Phosphorous, Ecological distribution, Solar radiation, Temporal distribution, Chlorophyll, Spring waters, Water quality, *France, *Loire River(France).

In order to evaluate the impact of nuclear of hydraulic works upon the middle reaches of the Loire, an ecological model was constructed and applied to the River Loire between the confluence of the River Allier and the city of Blois. This model simulated a simplified ecosystem near to a state of eutrophication. The state variables are the phytoplankton, the zooplankton, and the nutrients, nitrogen or phosphorus. The input data to the system were three-hourly average values of incoming solar radiation and the daily values of flow and water temperature. The aplication to the River Loire was restricted to phytoplankton, nitrogen, and phosphorus. The model was calibrated with weekly data measured in 1974 and 1975 at the Saint-Laurent-des-Eaux nuclear power plant, after the values of nitrogen and phosphorus input from the population bordering the river, from fertilizers spread over the basin and from the springs of the Beauce aquifer had been separately evaluated. (Humphreys-ISWS)
W79-08990

TRACE ELEMENTS IN THE SEDIMENTS OF SKADAR LAKE,
Institute of Biological Research, Belgrade (Yugoslavia).
G. Petrovic, and U. Schleichert.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1062-1066. 3 fig, 2 tab, 7 ref.

Descriptors: *Skadar Lake(Yugoslavia-Albania), *Trace elements, *Metals, *Organic matter, *Phosphorus, *Sediments, *Mine drainage, Lakes, Yugoslavia, Albania, Water level fluctuations, Water pollution sources, Littoral, Limnetic zone, Industrial wastes, Agricultural runoff, Moraca River(Yugoslavia), Crnojevica River(Yugoslavia), Rivers, Tributaries, Iron, Strontium, Barium, Titanium, Copper, Cobalt, Nickel, Chromium, Lead, Zinc, Cadmium.

Trace elements, organic matter, and phosphorus were determined for sediment samples collected 1972-73 and 1976 in the 0-15 cm layer in Skadar Lake, on the Yugoslavia-Albania border, and sources were investigated. High nickel and chromium levels were caused by nearby mining, and organic matter and phosphorus inputs derived partly from fish plant effluents. Skadar Lake, the largest of the Balkan Lakes, has a surface area of 372.3 sq km, is karstic with an average depth of only 3-6 m, and is characterized by great fluctuations in water level because of flooding of major tributaries and large inflow from cryptodepressions. The basin has in recent years been devoted to intensive industrial, agricultural, and urban uses; all wastes drain untreated into lake tributaries. The open lake exhibited lowest concentrations of all minor elements except manganese, and of organic matter and phosphorus. Highest levels of iron, strontium, barium, titanium, copper, cobalt, and especially nickel and chromium occurred at the mouth of the lake's major tributary, the Moraca River. Highest levels of organic matter, phosphorus, lead, zinc, and cadmium were found at sites influenced by the Crnojevica River. Cadmium levels were very high, reaching 10 ppm. Concentrations of nickel (25-168 ppm) and chromium (85-350 ppm) in sediments were considerably higher than in sediments of such other highly industrialized regions as in Lake Constance and Lake Michigan. (Lynch-Wisconsin)
W79-08991

ZOOBENTHOS FROM SUBLACUSTRINE SPRINGS IN LAKE SKADAR, CRNA GORA, YUGOSLAVIA,
Wisconsin Univ., Stevens Point. Coll. of Natural Resources.
G. Z. Jacobi.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1067-1077. 2 fig, 3 tab, 13 ref.

Descriptors: *Skadar Lake(Yugoslavia-Albania), *Benthic fauna, *Springs, *Cryptodepressions, *Vertical distribution, Depth, Density, Biomass, Yugoslavia, Distribution, Faunal lists, Lakes, Mollusks, Oligochaetes, Chironomidae, Tubificids, Midges, Snails, Amphipoda, Oligotrophy, Polypedium convictum, Valvata piscinalis, Pyrgula annulata, Viviparus viviparus, Chironomus plumosus, Echinogammarus scutarensis, Eutrophication, Bioindicators.

Vertical distribution, density, and biomass of macrozoobenthos was studied in seven springs, or cryptodepressions, located beneath Lake Skadar on the Yugoslav-Albanian border. The springs are concentrated along the southwestern and northern shores; formed by chemical dissolution, they are important in the water budget and to the physicochemical conditions of the lake. Though making up less than 1% of the lake volume, they yield up to 50% of the large annual fish catch. Springs studied included Radus, the deepest depression (60m), and lesser depressions Modra, Karuc, Volac, Djurovo, Nema Ime, and Krnjice. Thirty-seven taxa were identified; the highest number in one sample (19) was found at four m on the south edge of Radus. Dominant groups were Mollusca, Tubificidae, and Chironomidae, each present in over 85% of samples. Most ubiquitous species were the midge Polypedium convictum (78%), the snails Valvata piscinalis (50%), Pyrgula annulata (44%), and Viviparus viviparus (42%), the midge Chironomus Plumosus (30%), and the amphipod Echinogammarus scutarensis (30%). Highest faunal density was 8900/sq m in Djurovo at three m (99% Viviparus) and 6800/sq m in Radus at 17 m (65% tubificids, 18% Polypedium convictum). Maximum depth of several species for the lake was extended. The amphipod Synurella ambulans was the only species found at 53 m. The appearance and abundance of C. plumosus and the higher average weight of zoobenthos per sq m may indicate change in the lake's oligotrophic status. (Lynch-Wisconsin)
W79-08992

PHYTOPLANKTON PRODUCTION, PHYSICO-CHEMICAL CONDITIONS, AND NUTRIENT RELATIONSHIPS IN LAKE OHRID, YUGOSLAVIA,
Hidrobioloski Zavod, Ochrida (Yugoslavia).
B. T. Ocevski, and H. L. Allen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1078-1084. 2 fig, 12 ref. NSF GB-35374.

Descriptors: *Lake Ohrid(Yugoslavia-Albania), *Phytoplankton, *Primary productivity, *Nutrients, *Trophic level, Oligotrophy, Mesotrophy, Algae, Lakes, Albania, Yugoslavia, Water chemistry, Chemical precipitation, Absorption, Vertical distribution, Seasonal, Depth, Population dynamics, Succession, Dominant organisms, Bioassay, Carbon radioisotopes, Calcareous, Nutrient loading, Species composition, Chelation.

Lake Ohrid, on the border between Yugoslavia and Albania, had mean daily phytoplankton productivity of 291 mg C/sq m/day and an annual rate of 103.3 mg C/sq m/yr based on studies in 1974, which compare favorably with more-productive oligotrophic lakes and less-productive mesotrophic lakes. Although nutrient radiobioassay studies showed marked stimulation of productivity, indicating that continued increases in nutrient loading from the surrounding watershed could rapidly increase primary productivity rates, the calcareous nature of the lake would retard such an increase through physical-chemical mechanisms of coprecipitation and absorption onto the surface of monocarbonates. Such other factors as availability of suitable organic compounds to function as chelators are also important in suppressing phytoplankton productivity in the lake. Phytoplankton production dynamics were monitored spatially and temporally in the limnetic zone using conventional carbon-14 methods. Average monthly production rates, integrated through the trophogenic zone, varied from 63 mg C/sq m/day in December to 479 mg C sq m/day in July. Mean daily production was 36.8% higher in 1974 than in 1973. Phytoplankton undergo well-defined and highly predictable seasonal periodicity which is carefully regulated by changes in light, temperature, and nutrient availability. Changes in dominance correlated strongly with spatial and temporal changes in productivity rates. (Lynch-Wisconsin)
W79-08993

LITTORAL ZONE OF LAKE OHRID AND ITS MICROPHYTIC VEGETATION,
Hidrobioloski Zavod, Ochrida (Yugoslavia).
I. Cado.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1085-1089. 24 ref.

Descriptors: *Lake Ohrid(Yugoslavia-Albania), *Littoral, *Algae, *Aquatic plants, *Lithophytes, Ecology, Yugoslavia, Albania, Lakes, Diatoms, Chrysophyta, Navicula, Chlorophyta, Cyanophyta, Periphyton, Epilithic organisms, Epiphytes, Rhodophyta, Oligotrophy, Waves(Water), Speciation, Endolithophytes.

Microscopic vegetation of the well-defined littoral of Lake Ohrid, on the border of Yugoslavia and Albania, is described. Three characteristic zones are present: (1) supralittoral, designated the Gloecapsa-Scytonema zone; (2) eulittoral, the Microcoleus-Schizothrix-Bangia-Cladophora-Rivularia zone; and (3) infralittoral, characterized by higher species diversity. Two groups of factors affecting quantity, composition, structure, and distribution of the littoral lithophyte plant communities can be distinguished: (1) topography and other factors of specific importance to the plant composition of the total biotope, and (2) physiography and biotic factors which regulate the qualitative, quantitative, horizontal, vertical, and seasonal relationships. Three vegetative belts are identified: (1) wave splash, (2) flooded, and (3) submerged. Characteristic flora of each are described. Algal flora in Lake Ohrid is dominated by Bacillariophyceae, with 43 genera and 360 species, varieties, and forms. Navicula is the most numerous genus (79 subgeneric taxa), followed by Gomphonema and Cymbella with 25. Chlorophyta are well-represented, with 193 species and varieties, the majority planktonic. Cyanophytes are very important and Rhodophyta is represented by typical freshwater genera. Most of the lake's lithophytic algae are typical of oligotrophic waters, but some also occur in mesotrophic or eutrophic waters. (Lynch-Wisconsin)

W79-08994

ANNUAL VARIATIONS OF THE IMPORTANT ZOOBENTHIC POPULATIONS IN LAKE OHRID,
Hidrobioloski Zavod, Ochrida (Yugoslavia).
M. Tocko, and J. Sapkarev.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1090-1095, 5 fig, 16 ref.

Descriptors: *Lake Ohrid(Yugoslavia-Albania), *Benthic fauna, *Oligochaetes, *Amphipoda, *Isopoda, *Depth, *Eutrophication, Vertical distribution, Hirudinea, Chironomidae, Abundance, Annual, Yugoslavia, Albania, Population dynamics, Water pollution effects, Agricultural runoff, Tubificids, Density, Pesticides, Detergents, Fertilizers.

Long-term decline (1937-73) in average annual population density of benthic fauna in Lake Ohrid (Yugoslav-Albanian border) may be the result of very slow eutrophication, but data are not sufficient for definitive analysis. Significant changes by depth also occurred. Benthic fauna are dominated by Oligochaeta, Amphipoda, and Isopoda; Chironomidae and Hirudinea (leeches) are less abundant. Data were collected in 1937-39 (summer only) and 1953-55 with an Ekman dredge, and in 1964-65 and 1972-73 with a Peterson dredge. From 1953-73 samples were taken monthly. Oligochaetes are the most abundant, having 36 taxa with Tubificidae the most numerous family. Oligochaete population fluctuated considerably, particularly in the littoral; least variation was in the profundal; Average density was 4935 ind/sq m in 1937-39, 3053 in 1953-55, 2748 in 1964-65, and 1695 in 1972-73. Increasing use of fertilizers, pesticides, and detergents in the watershed may have caused the permanent decline. Amphipods, next in importance to Oligochaeta, are represented only by the family Gammaridae (seven taxa). Average density increased from 614 ind/sq m in 1937-39 to 800 in 1964-65, then declined to 492 in 1972-73. Isopods (Asellidae, eight taxa) averaged 338 ind/sq m in 1937-39, 552 in 1964-65, and 176 in 1972-73. Leeches declined 1963-73, and chironomids 1937-73. Charts show density changes by depth. (Lynch-Wisconsin)
W79-08995

WIND, PHOSPHORUS RELEASE AND DIVISION RATE OF PERIDINIUM IN LAKE KINNERET,
Israel Oceanographic and Limnological Research Ltd., Tiberias.
C. Serruya, S. Serruya, and U. Pollingher.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1096-1102, 6 fig, 17 ref.

Descriptors: *Lake Kinneret(Israel), *Winds, *Sediments, *Phosphorus, *Eutrophication, *Peridinium cinctum fa. westii, *Division rate, *Sediment-water interfaces, Lakes, Israel, Algae, Phytoplankton, Dinoflagellates, Pyrrophyta, Nutrients, Meteorology, Mixing, Reproduction, Plant physiology, Limiting factors, Nutrient loading.

In Lake Kinneret, Israel, wind pattern and intensity govern release of phosphorus from sediments and trigger an increase in the division rate of the dinoflagellate Peridinium cinctum fa. westii, resulting inmassive winter and spring blooms. Phosphorus levels depend on the duration and intensity of physical mixing, and not directly on external loading; they may be high even if external loading is reduced. Strong storms occur December-February, followed by a three-week windless period, usually in March, and then by a summer pattern of westerly periodic winds. Sediments are poor in nitrogen (0.26-0.48%) of carbonate-free dry wt. and rich in phosphorus (0.2-0.3%). The Peridinium cyst, denser than water, settles to the sediment surface where vegetative cells are born; they subsequently are recirculated by mixing. Newborn cells store large amounts of phosphorus while on sediments, and during the mixed period their intracellular phosphorus content remains high (1.0-1.5% dry wt). The windless period allows Peridinium to concentrate in the upper layers but isolates cells from phosphorus sources. The intracellular phosphorus stock is then distributed to daughter cells at each division, leading to a rapid drop in intracellular phosphorus (0.1% by May). The phosphorus limitation, together with such other factors as temperature, cause the bloom to decline. (Lynch-Wisconsin)
W79-08996

PRESENT STATE OF LAKE SEVAN (ARMENIA),
Akademiya Nauk Armyanskoi SSR, Sevan. Hydrobiological Station.
R. O. Oganesian.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1103-1104. 1 ref.

Descriptors: *Lake Sevan(USSR), *Eutrophication, *Water level fluctuations, *Succession, *Bioindicators, *Oligotrophy, Lakes, Soviet Union, Benthic fauna, Phytoplankton, Algae, Zooplankton, Dissolved oxygen, Nutrients, Fish, Productivity, Biomass, Cyanophyta, Diatoms, Crustaceans, Chironomidae, Solar radiation, Chrysophyta, Rotifers, Copepods.

Progressive eutrophication of oligotrophic Lake Sevan, Armenia, U.S.S.R., has been the result of a continuing decrease in water level (17 m to date). The lake formerly was characterized by high hypolimnetic oxygen (> eight mg/l), very low nitrogen and iron levels, no nitrogen fixation, phytoplankton dominated by small diatoms, low primary production, and dominance of zooplankton by copepods and fish by trout. At present (1976) the lake exhibits summer hypolimnetic oxygen depletion, increased nitrogen (0.14 mg/l annual mean) and iron (0.012 mg/l) content, high phosphate levels (0.06 mg/l), replacement of smaller by larger diatoms, appearance of cyanophytes (Anabaena, Aphanizomenon), primary production typical of eutrophic waters, increased role of rotifers (680 mg/cu m) and dominance by Cyclops (5270 mg/cu m) in zooplankton, and replacement of trout by Coregonus. Among benthic fauna, Chironomidae are now dominant, and biomass of the crustacean Gammarus lacustris decreased three-fold. A tunnel is under construction to reroute the Arpa River into Lake Sevan, which will increase the lake's water level, increase the hypolimnion volume, and improve the oxygen regime of the entire water column. Creation of the Sevan National Park will assist in preserving and restoring the lake. Relatively high water transparency led to increasing productivity of all main trophic levels. Phytoplankton production increased from 1.27 g O/sq m in 1958 to 8.5 g in 1976 (daily averages), with a ten-fold increase in biomass to six mg chl-a/cu m. (Lynch-Wisconsin)
W79-08997

CIRCULATIONS OF ORGANIC SUBSTANCE AND BIOLOGICAL PRODUCTIVITY OF LAKE BAIKAL,
Limnologicheskii Inst., Irkutsk (USSR).
G. I. Galazy.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologies; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1105-1107.

Descriptors: *Lake Baikal(USSR), *Organic matter, *Primary productivity, *Phytoplankton, *Photosynthesis, *Oligotrophy, Soviet Union, Lakes, Circulation, Algae, Zooplankton, Seals, Fish, Productivity, Limiting factors, Nitrates, Mesotrophy, Biomass, Seasonal, Carbon, Trophic level, Diatoms, Chrysophyta.

Phytoplankton photosynthesis is responsible for 90% of organic matter entering the trophic chains in Lake Baikal (U.S.S.R.). Absolute values of primary production per unit of water volume characterize the lake as oligotrophic, but thickness of the trophogenic layer results in high primary production values per sq m of lake surface, comparable to mesotrophic waters. Photosynthesis occurs to 50-70 m depth, with the compensation layer at 15-25 m. In summer, intensive photosynthesis occurs at 15 m. Annual primary production in the trophogenic layer averages 127 g C/sq m (range 66-158 g); the lakes southern and central parts are the most productive. Biomass in highly productive years in the trophogenic layers ranges 130,000-800,000 tons/yr, with an annual average of 200,000 tons fresh wt. Fresh wt of algae averages 6.5 g/sq m, or 260 g/cu m. Baikal waters are low in organic matter content (1.0-1.6 mg/l organic carbon). Nitrates limit photosynthesis August-September, and decrease to zero in the trophogenic layers. The production/biomass ratio varies greatly over a year, with an average of 304, a value approaching ocean ratios. Up to 75% of all new organic matter is decomposed annually. In the limnetic zone 92 phytoplankton species have been identified, dominated during biomass maxima in spring by diatoms, peridineans, or chrysophyceans. The lake's antiquity accounts for its well-balance ecosystem. Zooplankton, fish, and the Baikal seal are briefly discussed. (Lynch-Wisconsin)
W79-08998

ON THE GENESIS OF THE ROTATORIAN FAUNA ON BAIKAL LAKE,
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
L. A. Kutikova.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1978, Part 2, p 1108-1110. 12 ref.

Descriptors: *Lake Baikal(USSR), *Rotifers, *Zooplankton, *Benthic fauna, *Littoral, *Limnetic zone, *Paleolimnology, Ecology, Lakes, Soviet Union, History, Endemic, Zonation, Evolution, Species composition, Water temperature, Dissolved oxygen, Seasonal, Palearctic, Holarctic, Siberia(USSR), Coasts.

The rotifer fauna of Lake Baikal, U.S.S.R., differs from other faunal groups in the lake in that it is based not on endemic species, but rather on a Palearctic complex of species in both the limnetic and littoral zones. Baikal faunas are usually characterized by deep endemism, with endemic species inhabiting the open lake and forming the seasonally unique Baikal fauna, while a Siberian-European complex typical of Siberian eutrophic lakes inhabits the shallow littoral zones of bays, gulfs, and river estuaries. Among Lake Baikal rotifers, the Palearctic species (ancient paleolimnetic intruders that inhabited the pre-Baikal Lakes) and endemic species (mesolimnetic) probably have always inhabited Baikal simultaneously, but have been seasonally isolated from one another because of different ecological needs. Specifically, the endemic species need a relatively constant and low temperature (4-6 C) and high dissolved oxygen, and their population maximum occurs in early spring. The Siberian-European complex of the Baikal rotifer fauna cannot be synonymized with the coastal complex; the former includes not only the truly coastal thermophilic and mesotrophic species but also the cold-stenothermic, oligotrophic, planktonic, and littoral forms on which the rotifer fauna is based. In 1972-74, 105 rotifer species were found, 27 endemic. The littoral contains 81% of the endemic fauna. (Lynch-Wisconsin)
W79-08999

SALINITY INTRUSION INTO LAKE SONGKLA, A LAGOONAL LAKE OF SOUTHERN THAILAND,
Prince of Songkla Univ. (Thailand). Faculty of Natural Resources.
D. Limpadanai, and P. Brahamanonda.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoreoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1111-1115. 2 fig, 1 tab, 17 ref.

Descriptors: *Lake Songkla, *Salinity, *Saline water intrusion, *Lagoons, *Water pollution ef-

fects, Lakes, Thailand, Tidal effects, Channel improvement, Irrigation, Rainfall, Heavy metals, Osmoregulation.

Seasonal salinity fluctuations in lagoonal Lake Songkla, southern Thailand, are caused by a month of heavy rainfall (up to 800 mm) toward the end of each year, which coincides with salinity levels as low as zero ppt, and tidal flow into the lakes southern inlet, resulting in maximum salinity levels of 32 ppt. Salinity in the southern basin has increased since 1967 from a maximum of 20 ppt to the current 32-ppt maximum, due primarily to dredging of the outlet channel. Dredging removed 2.1 million cu m of silt in 1967 and 0.5 million cu m in 1972. Water resources development in the western part of the watershed, including paddy field irrigation, is not a major contributor to increased salinity. Effects of salinity increase on aquatic organisms in the lake are unknown, but other studies indicate aquatic organisms tolerated certain amount of salinity change. However, if osmoregulation is altered by such influences as heavy metals, mortality may result, as has been demonstrated for isopod crustaceans. Salinity was monitored at four stations; data are given for 1965-67, 1969, and 1971. The maximum salinity of 32 ppt was recorded in September, with a secondary peak in April. Zero ppt occurred in December and January. (Lynch-Wisconsin)
W79-09000

MACROINVERTEBRATES AS AN IMPORTANT SUPPLIER OF NITROGENOUS NUTRIENTS IN A DENSE MACROPHYTE ZONE IN LAKE BIWA,
Kyoto Univ., Otsu (Japan). Otsu Hydrobiological Station.
T. Miura, K. Tanimizu, Y. Iwasa, and A. Kawakita.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1116-1121. 2 fig, 1 tab, 9 ref.

Descriptors: *Lake Biwa(Japan), *Nitrogen, *Shrimp, *Snails, *Elodea densa, *Nutrient budgets, *Excretion, Japan, Lakes, Invertebrates, Nutrients, Cycling nutrients, Limiting factors, Primary productivity, Ammonia, Photosynthesis, Paratya compressa, Palaemon paucidens, Macrobrachium nipponense, Sinotaia histrica, Seimisulcospira decipiens, Biomass, Equations, Seasonal, Symbiosis.

Three shrimp species in a dense community of the aquatic macrophyte Elodea densa in Japan's Lake Biwa were important suppliers of ammonia and other forms of nitrogen during June and July when Elodea production was highest. Two snail species, though accounting for twice as much biomass in terms of nitrogen as the shrimp, had very low nitrogen excretion rates and were thus less important as nitrogen suppliers. The shrimp (Paratya compressa, Palaemon paucidens, and Macrobrachium nipponenense) and snail (Sinotaia histrica and Semisulcospira decipiens) dominate animal biomass in the Elodea community. Seasonal fluctuation of the net production rate of Elodea was studied 1974-75; daily net production rate during the most productive month (June) was 13.8 g dry wt/sq m. And annual net production was 1044 g dry wt/sq m (36.5 g N/sq m), and annual loss was 1095 g dry wt/sq m (38.3 g N/sq m). The shrimp supplied 61 mg N/sq m/day in June, or about 60% of the negative value of the nitrogen balance. Among freshwater crustaceans 62-70% of nitrogen excretion is ammonia, compared with 42% among freshwater snails. Allochthonous nutrients were not likely to have reached the plant zone due to the plant's obstruction of water exchange, and supply of nitrogenous nutrients from nitrogen regeneration from decaying plants was inadequate to meet demand in June and July. Neither the omnivorous-carnivorous shrimp nor the snails (which graze attached algae) graze the Elodea. (Lynch-Wisconsin)
W79-09001

DISTRIBUTION OF PHOSPHATE, NITRITE AND SILICATE IN LAKE EDKU, EGYPT,
Alexandria Univ. (Egypt). Dept. of Oceanography.
M. A. H. Saad.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1124-1130. 2 fig, 3 tab, 29 ref.

Descriptors: *Phosphates, *Nitrites, *Silicates, *Lake Edku(Egypt), *Nutrients, *Distribution, *Seasonal, Egypt, Lakes, Saline water intrusion, Saline lakes, Brackish water, Mediterranean Sea, Fisheries, Phytoplankton, Algae, Diatoms, Chrysophyta, Winds, Denitrification, Degradation(Decomposition).

During a 1969-70 study, distribution of phosphate, nitrite, and silicate varied seasonally in Lake Edku, a shallow brackish-water lake 30 km northeast of Alexandria, Egypt, and connected to the Mediterranean Sea by a narrow passage, Boughaz El-Maadiah. The lake's fishery is of considerable economic importance. Depth ranges 50-150 cm, and lake water is derived primarily from three drains and the sea. Six sample sites represent all parts of the lake. Average phosphate values ranged from 45.3 mu-g PO4/l in March to 518.3 mu-g in September, nitrite from 9.3 mu-g NO2/l in February to 82.8 mu-g in July, and Silicate from 1.0 mu-g SiO2/l in March to 5.9 mu-g in August. At the six stations, phosphate ranged from a low of nine mu-g to a high of 84.0 mu-g, nitrite from 4.9-204.0 mu-g, and silicate from 0.6-7.5 mu-g. Seasonal nutrient variations have not been correlated with phytoplankton production or lake turnover rate since nutrient concentrations are mainly controlled by seasonal fluctuations in drainage waters entering the lake. Average nutrient values were higher at the three stations located near the drains, while stations near the seawater inflow had lower values. Phosphate level increases are attributable to increased phytoplankton decay, nitrite increases are due to denitrification, and silicate levels are strongly influenced by diatom population. (Lynch-Wisconsin)
W79-09002

LIMNOLOGICAL AND PALEOLIMNOLOGICAL DATA ON THE BALE MOUNTAIN LAKES (ETHIOPIA),
Vienna Univ. (Austria). Zoologisches Inst.
H. Loffler.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1131-1138. 4 fig, 2 tab, 19 ref.

Descriptors: *Lakes, *Limnology, *Paleolimnology, *Bale Mountains(Ethiopia), *Mountain lakes, *Africa, Ethiopia, Zooplankton, Phytoplankton, Algae, Benthic fauna, Ostracoda, Daphnia obtusa, Copepods, Cladocera, Glacial lakes, Garba Guratsch(Ethiopia), Cold regions, Diatoms, Chydorus, Hora Orgona(Ethiopia), Biogeography, Cores, Campylodiscus noricus, Chrysophyta, Palearctic.

The Bale Mountains of Ethiopia are the northernmost high mountain range in Africa containing lakes situated above the timberline and therefore subject to cold polymictic conditions. Fifteen of the area's 100 lakes and ponds were investigated April 1976 to obtain paleolimnological information and to study zoogeographical relationships to similar lakes further south in East Africa. Most of the lakes were formed or influenced by glaciation. Water temperatures in April range 10-12 C in the larger lakes, Hora Orgona and Garba Guratsch, and 0-29 C in shallow ponds. Virtually no rotifers or phytoplankton (except nannoplankton) are present. Zooplankton are uniform and composed exclusively of palearctic species: Daphnia obtusa, Arctodiaptomus (Rhabdiaptomus) n. sp., and Megacyclops viridis. The heavily pigmented D. obtusa represents the first pigmented Daphnia in Africa, and must be considered one of the earliest colonists of the Bale lakes. By contrast, benthic Cladocera, benthic copepods (except Paracyclops fimbratus), and ostracods belong to African taxa, demonstrating the close relationship between fauna of the genera Macrothrix, Leydigia, Alona, Alonella, and Chydorus. A core taken from a shallow lake showed Daphnia obtusa to have been continuously pigmented from its first appearance. Campylodiscus noricus was the most common diatom in the core, and is still abundant. (Lynch-Wisconsin)
W79-09003

CASE STUDIES OF LAKE ECOSYSTEMS AT DIFFERENT LATITUDES. THE TROPICS. THE LAKE GEORGE ECOSYSTEM,
City of London Polytechnic (England). Dept. of Biological Sciences.
M. J. Burgis.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1139-1152. 4 fig, 4 tab, 85 ref.

Descriptors: *Lake George(Uganda), *Ecosystems, *Tropical regions, *Stability, *Biological communities, *Cycling nutrients, *Seasonal, Lake morphology, Climate, Uganda, Lakes, Cyanophyta, Algae, Phytoplankton, Microcystis, Herbivores, Zooplankton, Thermocyclops hyalinus, Nitrogen, Nutrients, Rainfall, Stratification, Fish, Grazing, Feeding rates, Food habits.

Lake George, Uganda, is an uncharacteristically stable tropical lake, a product of its equatorial position, morphology, local geography, and climate. Whereas most tropical lakes have marked seasonal changes, Lake George experiences little seasonal change in solar radiation, day length (12.1 hrs), temperature, wind, flow through, and depth (mean 2.4 m, maximum 3.0 m). The lake stratifies and mixes in a daily cycle, and is protected by mountains. An important feature of the Lake George biological community is its dominance by herbivores (such as the cyclopoid copepod Thermocyclops hyalinus) able to use blue-green algae as food, especially Microcystis. Fish biomass is also dominated by herbivores (60%), Sarotherodon niloticus (Tilapia nilotica) and Haplochromis nigripinnis, which feed directly on the phytoplankton. Both the planktonic and fish herbivores exhibit diurnal feeding cycles. However, a relatively small proportion of primary production is converted into consumer production, indicating a rather inefficient system. Gross primary production is estimated at 82,400 kJ/sq m/yr, and herbivore production at 650 kJ/sq m/yr. The zooplankton population is remarkably constant seasonally, not the case with all tropical lakes including Lake Edward (Amin) with which Lake George is connected. The very large phytoplankton standing crop is greatly and continuously dependent on internal nutrient recycling, probably another function of the system's stability. (Lynch-Wisconsin)
W79-09004

GROWTH AND PRODUCTION OF AQUATIC MACROPHYTES IN A SOUTH TEMPERATE LAKE CLIMATE,
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.
C. Howard-Williams.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1153-1158. 3 fig, 12 ref.

Descriptors: *Macrophytes, *Chara globularis var. krausii, *Potamogeton pectinatus, *Swartvlei(South Africa), *Primary productivity, *Plant growth, Phytoplankton, Algae, Lakes, Saline lakes, Coasts, South Africa, Phenology, Biomass, Color, Phosphorus, Sediments, Nutrients, Fish reproduction, Habitats, Limiting factors, Light penetration, Estuaries, Fisheries, Temperate.

Though maximum phytoplankton production in Swartvlei, a South African coastal saline lake, is the lowest recorded for an African water body (5-13 mg C/cu m/hr), maximum Potamogeton pectinatus productivity (16 g/sq m/day) and biomass in the littoral are among the highest as described in the literature. The shallow littoral (< three m) supports dense beds of Potamogeton (0.64 sq km in water 100-300 cm deep) and Chara globularis var.

krausii (1.61 sq km in water 30-100 cm deep). In the many South African coastal lakes with sea connections, such as Swartvlei, macrophyte beds help these systems function as marine fish nurseries. Besides directly providing juvenile fish with shelter and food, the plants are a habitat for an extremely large invertebrate population which provides additional food. In view of its low planktonic production, Swartvleis suitability as a fish nursery seems largely dependent on its high macrophyte production. Phytoplankton production appears limited by poor light transmission of the brown water (from humic compounds in inflowing rivers) and by very low dissolved phosphorus levels, whereas Potamogeton's photosynthetic tissue is concentrated in the upper 50 cm of the water column and the plant can absorb nutrients from the phosphorus-rich littoral sediments. Chara total production is calculated at 423 million g/yr, and for Potamogeton 1.6 billion/g/yr, compared with 700 million g for plankton. The growth cycle of potamogeton is described. The greatest proportion of lake organic matter inputs come from the littoral. (Lynch-Wisconsin)
W79-09005

FACTORS LIMITING ALGAL GROWTH ON THE SUB-ANTARCTIC ISLAND MARION,
Orange Free State Univ., Bloemfontein (South Africa). Inst. for Environmental Science.
J. U. Grobbelaar.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol 20, September 1978, Part 2, p 1159-1164. 4 fig, 1 tab, 14 ref.

Descriptors: *Marion Island, *Limiting factors, *Algae, *Lakes, *Cold regions, *Nutrients, *Water temperature, Islands, South Africa, Nitrogen, Phosphorus, Periphyton, Benthic flora, Phytoplankton, Species diversity, Bioassay, Algal growth potential, Gentoo Lake(South Africa), Skua Lake(South Africa), Albatross Lake(South Africa), Chlorophyll, Adaptation, Chlorella, Scenedesmus, Plant growth, Habitats.

Algal growth in several freshwater lakes on sub-Antarctic Marion Island, in the Prince Edward Island group about 600 miles south of Africa, is limited primarily by low temperatures and poor water quality. Most of the algae have low chlorophyll content, and survive in a hostile environment. Algal growth potential (AGP) bioassays shows that both nitrogen and phosphorus are limiting in the lakes, which possess extremely low AGPs in surface waters. Average annual temperature on the island is 5.1 C, precipitation exceeds 2500 mm/yr, and average wind speed is 27 km/hr. Marion Island is located at 46 degrees 53' S and 37 degrees 45' E. Flora and fauna have low species diversity, which, together, with a general lack of endemic forms, is attributed to glaciation and to the island's young geological age and westerly position in the Kerguelen Province, signifying a migration route against prevailing westerly winds and oceanic currents. Planktonic algae are scarce in the freshwater habitats, but periphyton and benthic algal felts and mats are abundant. In laboratory tests both Chlorella sp and Scenedesmus sp exhibit maximum growth rates at 22 C. Absorption of radiant energy by algae to achieve temperatures above that of their surroundings is very important in cold environments; on Marion Island temperature differences up to 4.5 C were measured between benthic algal felts and overlying waters. Skua Lake's AGP is 6.0% of Chu's medium no. 10, Skua Lake no. 4 is 5.9%, Albatross Lake no. 1 is 0.6%, study area no. 1 lava-lakelet is 5.8%, and Gentoo Lake is 12.3%. (Lynch-Wisconsin)
W79-09006

LIMNOLOGY OF VICTORIAN SALT LAKES, AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Zoology.
W. D. Williams.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1165-1174. 3 fig, 71 ref.

Descriptors: *Saline lakes, *Limnology, *Aquatic animals, *Water chemistry, *Victoria(Australia), Lakes, Australia, Osmoregulation, Ecosystems, Temperate, Salinity, Hydrogen ion concentration, Dissolved oxygen, Macrophytes, Phytoplankton, Algae, Biological communities, Species diversity, Species composition, Reviews, Ions, Halotolerance, Lake Bullenmerri(Australia), Lake Corangamite(Australia), Lake Beeac(Australia), Lake Werowrap(Australia), Halophilic animals.

Recent studies of salt lakes (3% salinity) in Victoria, Australia, are summarized. These lakes are of particular interest because they vary widely in salinity (> 1 to 350%), are ionically homogeneous, have distinctive and markedly endemic fauna, and range from shallow temporary water bodies to deep permanent lakes. The lakes are most numerous in an endorheically drained, flat, temporate region 150 km west of Melbourne, largely a broad volcanic basaltic plain of Quaternary age. Summers are warm and dry, winters wet and cool. Surface water temperatures range 10-24 C in the deeper lakes, and 10 C to over 30 C in the shallow lakes. The consistent pattern of ionic dominance is Na Mg K Ca:Cl SO4 HCO3 + CO3. The pH of all lakes exceeds eight, sometimes nine. The lakes are well-buffered. Salinity and oxygen are strongly correlated, and species diversity is inversely correlated with salinity. Three faunal groups can be distinguished: (1) halobionts (50-100% salinity), including an anostracan, three ostracods, three copepods, an isopod, a chironomid, and a ceratopogonid; (2) halophiles (10-60% salinity, including three rotifers, two copepods, a cladoceran, a cnidarian, and a gastropod; and (3) salt-tolerant freshwater forms (< 1-20% salinity), a copepod, amphipods, odonates, and corixids. Botanical investigations have been few; the most important macrophytes are species of Ruppia, Lepilaena, Potamogeton, and Enteromorpha. (Lynch-Wisconsin)
W79-09007

MICROBIAL ACTIVITY AND BIOMASS RELATIONSHIPS IN 26 OLIGOTROPHIC TO MESOTROPHIC LAKES IN SOUTH ISLAND, NEW ZEALAND,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.). Dept. of General Limnology.
M. J. Spencer.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1175-1181. 4 fig, 26 ref.

Descriptors: *Biomass, *Trophic level, *New Zealand, *Lakes, *Heterotrophic potential, *Microorganisms, Bacteria, Oligotrophy, Mesotrophy, Eutrophication, South Island(New Zealand), Heterotrophy, Phosphorus, Nitrogen, Nutrients, Chlorophyll, Adenosine triphosphate, Glacial lakes, Mixing.

Relationships between microbial activity and biomass parameters are described for 26 lakes on South Island, New Zealand, ranging from oligotrophic to mesotrophic. Microbial activity was determined by heterotrophic potential technique (maximum rate of uptake and respiration of carbon-14 glucose, or V sub max). Biomass parameters include direct bacterial counts, microbial adenosine triphosphate (ATP), total nitrogen (TN), and total phosphorus (TP), measured during summer studies (1976-77) of trophic status in the lakes, located near Canterbury. On the basis of heterotrophic potential, 15 lakes are classified oligotrophic and 11 mesotrophic. V sub max correlates well with total bacterial numbers, total nitrogen, and total phosphorus. Grouping the lakes by V sub max vs microbial ATP concentrations yields classifications consistent with trophic level. Chlorophyll-a and bacterial numbers correlate significantly with microbial ATP, TN, and TP concentrations for all lakes. The lakes are predominantly glacial, and range large/deep-small/shallow. Strong winds usually prevent thermal stratification. Heterotrophic potentials range 0.00032-0.0833 mu-g glucose/l/hr. Chlorophyll-a concentrations are generally less than four mu-g/l, but two lakes have concentrations of about seven mu-g/l. (Lynch-Wisconsin)
W79-09008

EFFECTS OF DIFFERENT SILT LOADS AND OF HYDRO-ELECTRIC DEVELOPMENTS ON FOUR LARGE LAKES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
V. M. Stout.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1182-1185. 2 fig, 1 tab, 1 ref.

Descriptors: *New Zealand, *Lakes, *Siltation, *Turbidity, *Environmental effects, *Hydroelectric powerplants, Waitaki River(New Zealand), Lake Tekapo(New Zealand), Lake Pukaki(New Zealand), Lake Ohau(New Zealand), Lake Benmore(New Zealand), Chlorophyll, Phytoplankton, Algae, Zooplankton, Copepods, Cladocera, Desmids, Diatoms, Oligotrophy, Secchi disks, Baseline studies, Mixing, Chlorophta, Chrysophyta, Glacial lakes, Rivers.

Phytoplankton and zooplankton composition in four large lakes in the Waitaki River system (South Island, New Zealand) are strongly related to turbidity levels, determined by silt inputs from inflowing rivers. Planned modifications to increase hydroelectric production will alter flow among the lakes, and therefore are likely to change the biological regimes. Lakes Tekapo, Pukaki, and Ohau are natural oligotrophic glacial lakes in the river's headwaters, and are influenced most by inflowing silt. Lake Benmore, uppermost of three impoundments, receives outflows from the three upper lakes; modifications will reduce flow into Benmore from Tekapo and Pukaki. Water in the three upper lakes has low chemical content, and strong winds reduce stratification; Benmore is shallower and more strongly stratified. Secchi disc readings average 9.36 m in Ohau, 4.99 m in Tekapo, and 0.57 m in Pukaki. Chlorophyll-a content is low in all lakes (often less than one mg/cu m), and lowest in Tekapo. Tekapo and Pukaki have few phytoplankton species dominated by diatoms. Ohau, the clearest lake, has a more varied algal flora dominated by desmid chlorophytes. In Benmore a Pukaki-like phytoplankton gave way to one resembling that in Ohau when flow was reduced from Pukaki and Tekapo. Zooplankton populations are dominated by rotifers in Pukaki, by the calanoid copepod Boeckella dilatata in Tekapo, and by the cladoceran Bosmina meridionalis in Ohau. (Lynch-Wisconsin)
W79-09009

ZOOPLANKTON OF LAKE VALENCIA (VENEZUELA) I. SPECIES COMPOSITION AND ABUNDANCE,
A. de Infante.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1186-1191. 4 fig, 2 tab, 7 ref.

Descriptors: *Lake Valencia(Venezuela), *Species composition, *Zooplankton, *Abundance, *Eutrophication, *Water pollution, Species diversity, Venezuela, Lakes, Faunal lists, Water levels, Dessication, Nutrients, Salinity, Saline lakes, Tropical regions, Alkalinity, Phosphorus, Phytoplankton, Algae, Rotifers, Copepods, Cladocera, Nutrient loading, Succession, Water pollution sources.

Pollution of Lake Valencia, the largest natural lake in Venezuela (350 sq km), by streams and canals containing domestic, industrial, and agricultural wastes is causing rapid dessication and eutrophication. This paper reports the first zooplankton evidence for eutrophication. In the last 250 years water level has declined more than 20 m and salinity has increased eight-fold. Lake Valencia has one of the highest phosphorus loading rates among large tropical lakes on an areal basis. Zooplankton abundance almost tripled 1968-1976. The number of species increased from 24 in 1956 to 40 in 1976 though the change may be due in part to more intensive sampling in the 1976 survey. Rotifers increased the most in abundance 1968-76; Ketatella americana remains the most abundant species and tripled in density. Brachionus spp also increased

dramatically; B. calyciflorus is the most abundant. Brachionus, a rotifer restricted to alkaline waters, is favored in Lake Valencia with a pH of about 9.0. Cladocera, scarce in 1968, have declined further. Among copepods, Notodiaptomus venezolanus has been displaced by Thermocyclops hyalinus, now dominant. Cyanophytes dominate phytoplankton throughout the year. Phytoplankton, scarce in 1968, have increased a thousand-fold. Shannon-Wiener diversity index values range 0.84 to 2.09. (Lynch-Wisconsin)
W79-09010

CHLOROPHYLL PIGMENTS IN THE CENTRAL AMAZON LAKES ECOSYSTEM,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.). Dept. of Tropical Ecology.
H. Rai.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1192-1197.

Descriptors: *Amazon Basin, *Lago Tupe(Brazil), *Lago Janauari(Brazil), *Chlorophyll, *Organic matter, *Water level fluctuations, Ecosystems, Cycling nutrients, Carbon, Particulate organic carbon, Nutrients, Photosynthesis, Seasonal, Euphotic zone, Productivity, Phytoplankton, Algae, Bacteria, Pheo-pigments, Brazil, Distribution, Pigments, Lakes, Detritus, Cycles, Black-water lakes.

The yearly cycle of chlorophyll-a and pheo-pigment distribution in two central Amazon lakes (Brazil), Lago Janauari, a mixed-water lake, and Lago Tupe, a black-water lake, was studied according to relationships among chlorophyll, carbon, bacteria, and nutrients. Results show that rapid recycling of organic matter in the upper photic zone maintains ecological equilibrium in the Amazon aquatic ecosystems. The relationship between bacteria and phytoplankton is complex and varies according to differences in the lake environment, especially in regard to water level fluctuations, an important regulator of microbiological productivity. Chlorophyll-a data must be corrected for pheo-pigments before use as an index of phytoplankton biomass. In Lago Janauari data on chlorophyll and particulate organic carbon (POC) indicate large chlorophyll concentrations do not have correspondingly high carbon values. Low POC:chlorophyll ratios in the lakes during low water implies increased phytoplankton growth accompanied by relatively larger amounts of autochthonous detrital POC. High bacterial densities in Lago Tupe during December, February, and March, and in Lago Janauari in October and December coincide with high chlorophyll-a, but relationships also have been observed between low bacterial densities and high chlorophyll-a, and between high bacterial densities and low chlorophyll-a, conditioned by several factors including phytoplankton composition. (Lynch-Wisconsin)
W79-09011

PRELIMINARY COMPARISON OF THE CRUSTACEAN PLANKTON OF A WHITE WATER AND A BLACK WATER LAKE IN CENTRAL AMAZONIA,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
G. O. Brandorff.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1198-1202. 3 fig, 1 tab, 5 ref.

Descriptors: *Lago Castanho(Brazil), *Lago Taruma-mirim(Brazil), *Amazon Basin, *Crustaceans, *Zooplankton, *Water level fluctuations, Brazil, Lakes, Faunal lists, Black-water lakes, Bosminidae, Daphnia, Cladocera, Copepods, Hydrogen ion concentration, Species composition, Ria lakes, Secondary productivity.

Comparison of zooplankton data black-water Lago Taruma-Mirim and white-water Lago Castanho in Brazil's Amazonia Province shows that, while planktonic crustaceans in the black-water lake are somewhat smaller and occur in lower numbers than in the white-water lake, differences are not as significant as assumed. Secondary production of the crustacean plankton likewise probably is not as low as often thought. Taruma-mirim is a ria lake with low pH, water darkly colored by humic acids, poor electrolyte content, and almost no macrophytes. Castanho, located in Pleistocene alluvium, has a nearly neutral pH, relatively good nutrient supply, relatively high phytoplankton production, and abundant macrophyte growth. Castanho has 10 cladoceran taxa, three cyclopoid copepods, and five calanoid copepods, while Taruma-mirim has nine cladocerans, one cyclopoid copepod, and seven calanoid copepods. A striking number of Bosminidae taxa are present in Taruma-mirim, including three species of Bosminopsis. More Daphnid taxa were found in Castanho than in Taruma-mirim. Indirect connection of both lakes with the Amazon causes great annual fluctuations in water level averaging 10 m. In Castanho water level correlates inversely with crustacean plankton abundance, while in Taruma-mirim the reverse is true. (Lynch-Wisconsin)
W79-09012

THE HEAT BUDGET OF A LARGE TROPICAL LAKE, LAKE TITICACA (PERU-BOLIVIA),
California Univ., Davis. Div. of Environmental Studies.
T. Kittel, and P. J. Richerson.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1203-1209, 3 fig, 1 tab, 17 ref. NSF GA-34099, BMS 75-14273.

Descriptors: *Lake Titicaca(Peru-Bolivia), *Tropical regions, *Heat budgets, *Mixing, *Thermal stratification, *Heat exchange, Peru, Bolivia, Lakes, Circulation, Weather, Meteorological data, Water temperature, Air temperature, Monomixis, Seasonal, Depth, Temperate.

The heat budget of Lake Titicaca (Peru, Bolivia), studied in 1973, provides information on factors controlling mixing and heat exchange in tropical lakes. Reduced seasonality at lower latitudes produces near-equilibrium of heat inputs and outputs, and heat storage consequently results from small fluctuations in net radiation and evaporative heat loss (the main budget terms), and the lake is only weakly stratified. By contrast, in temperate lakes high annual climate oscillation produces strong and relatively regular seasonal changes; most or all show very large storage terms. Epilimnetic temperatures in Lake Titicaca were above median air temperatures for every month in 1973; most low-latitude lakes probably have epilimnion temperatures higher than mean air temperatures all year. Elevated water temperature increases all heat outputs until high radiation inputs are nearly balanced, but only in equable climates since in temperate lakes water temperatures lag behind season to the extent that sensible heat transfer (H) is often a heat input in summer. Most well-studied tropical lakes of intermediate depth have circulation patterns similar to Lake Titicaca's, with only one annual mixing. However, year-to-year variations may have only small effects on circulation. Lake depth is probably more important than altitude in producing departures from the warm monomictic pattern in tropical and equatorial lakes. (Lynch-Wisconsin)
W79-09013

MARITIME ANTARCTIC LAKES,
British Antarctic Survey, Cambridge (England).
R. B. Heywood.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1210-1215. 1 fig, 2 tab, 8 ref.

Descriptors: *Antarctic, *Cold regions, *Signy Island(Antarctica), *Eutrophication, *Vegetation, *Lakes, Amos Lake(Antarctica), Heywood Lake(Antarctica), Sombre Lake(Antarctica), Biocoenoses, Phytoplankton, Algae, Benthic flora, Epiphytes, Nutrients, Seals, Excrement, Chlorophyll, Turbidity, Glacial lakes, Limnology, Limiting factors, Phosphates.

The British Antarctic Survey has shown that Antarctic lakes are unique in that their biocoenoses are simple, and that they lack vascular and emergent plants, insects, mollusks, and vertebrates; these characteristics are largely due to their isolation but also to short, cold summers. However, the biota of Signy Island lakes, the subject of this paper is relatively rich, reflecting proximity of the cold temperate zone of South America. The 17 small glacial lakes and numerous pools present a wide range of physico-chemical regimes. Only plants are described in this study. Winter plant and microbial activity determines success of Antarctic freshwater biocoenoces. In the lakes 139 species of benthic algae have been recognized, including 68 Bacillariophyta, 52 Chlorophyta, 17 Cyanophyta, and two Zanthophyta. Shallow shelf areas, which freeze solid for much of the year, support a simple ephiphytic community on Phormidium sp. felt. Lakes with clear, nutrient-poor waters have well-developed, species-rich, perennial vegetation based on a Tolypothrix sp and Plectonema sp. felt, while turbid, nutrient-rich lakes have sparse, species-poor seasonal vegetation. Phytoplankton, qualitatively and quantitatively poor, comprises 23 species: 11 Chlorophyta, five Chrysophyta, four Cryptophyta, two Bacillariophyta, and one Prasinophyta. Phytoplankton abundance generally is inversely related to that of benthic flora, a function of turbidity rather than competition. Eutrophic Amos Lake, the most affected by seal excrement, has high nutrient levels, poor transparency, poor planktonic flora, and negligible benthic flora. (Lynch-Wisconsin)
W79-09014

AUTOMATIC CONTINUOUS OXYGEN- AND TEMPERATURE-PROFILE MEASUREMENTS,
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands).
K. Kersting.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977, Vol. 20, September 1978, part 2, p 1216-1220. 4 fig, 2 ref.

Descriptors: *Measurement, *Instrumentation, *Dissolved oxygen, *Water temperature, *Lakes, *Stratification, Research equipment, Winches, Sensors, Monitoring, Depth, Profiles, Methodology, Lake Maarsseveen(Netherlands), Netherlands, Thermistors, Data storage and retrieval, Data collection, Automatic control, Continuous monitoring.

Portable, battery-powered equipment provides automatic and continuous measurement of the diurnal oxygen regime and temperatures in a stratified lake. The system consists of: (1) an automatic winch for lowering and raising the sensors, and (2) a signal conditioning and registration unit. The suspension cable also serves as a power line for the submersible stirrer, essential for accurate oxygen measurements. A 12-volt DC motor drives a cable drum and wormscrew. Sensors include a Y.S.I. 5419 dissolved oxygen probe and a Y.S.I. 401 thermistor. Data are stored on compact magnetic tape cassettes by a Micradata Model 200 data logger made up of two modules: (1) an 8-bit A/D converter, tape deck, 12-channel multiplexer, clock, and power pack; and (2) transducer signal conditioning cards. Seven of these cards are plugged into the Interface Unit: (1) reference card/scan marker; (2) scan counter; (3) potentiometer input card for depth registration; (4) 10 mV full-scale amplifier card for light registration (a LI-COR model LI-192S Quantum sensor with millivolt adaptor is used as the sensor); (5) 150 mV full-scale amplifier card for oxygen registration (the recorder output of a Y.S.I. 54 RC oxygen meter is used as input); (6) thermistor input card measuring temperatures 0-30 C with the thermistor as sensor; and (7) 110 mV full-scale amplifier card for eventual extra measurements of dawn, dusk, and underwater light intensities. The system has been used in the Dutch sandpit lakes Maarsseveen I and II with an error rate of 2-10 per 40,000 8-bit words. (Lynch-Wisconsin)
W79-09015

ESTIMATION OF THE INORGANIC FRACTION OF TOTAL CARBON IN AQUATIC INVERTEBRATES,

Helsinki Univ., Lammi (Finland). Lammi Biological Station.
K. Salonen, and J. Sarvala.

In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1221-1225. 1 fig, 1 tab, 9 ref.

Descriptors: *Carbon, *Invertebrates, *Methodology, *Analytical techniques, *Inorganic carbon, *Measurement, Indicators, Biomass, Mollusks, Organic carbon, Total carbon, Ash, Estimating, Ignition, Combustion, Acids, Faunal lists.

Several methods are compared for fractionating total carbon in aquatic invertebrates into organic and inorganic parts. In using total carbon to represent organic carbon as a measure of biomass, the inorganic fraction must be subtracted when, as with shelled invertebrates, the organism contains large quantities of inorganic carbon. Direct methods of determining inorganic carbon include: (1) ignition and analysis of carbon from ash, and (2) acidification and subsequent analysis of evolved carbon dioxide. An indirect method involves determination of calcium, assuming all calcium is present as calcium carbonate. Results show that for animals with less than 10% ash the calcium method overestimates inorganic carbon by several times compared with direct determination by combustion at 950 C and measurement of carbon dioxide. In animals with more than 50% ash practically all calcium can be accounted for by calcium carbonate; for mollusks the two methods agree well since calcium carbonate is a major shell component. The direct method may underestimate inorganic carbon if samples contain bicarbonates or magnesium carbonate, which decomposes at 500 C. In animals with less than 10% ash, inorganic carbon constitutes only 0.003-0.13% of total carbon, and even if all ash is taken to be CaCO3 the value would not exceed 2%. In such cases total carbon is a reasonable measure of organic carbon. (Lynch-Wisconsin)
W79-09016

DETERMINATION OF PHOSPHATASE ACTIVITY IN LAKE WATER--A STUDY OF METHODS,

Uppsala Univ. (Sweden). Inst. of Limnology.
K. Pettersson, and M. Jansson.

In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1226-1230. 7 tab, 5 ref.

Descriptors: *Methodology, *Measurement, *Phosphatases, *Limiting factors, *Lakes, *Artificial substrates, Fluorometry, E coli, Enzymes, Phytoplankton, Phosphorus, Phosphates, Nutrients, Algae, Water temperature, Hydrogen ion concentration, Alkalinity, Hydrolysis, Assay, 4-methylumbelliferyl phosphate, 3-O-methylfluorescein phosphate, 1-naphtol phosphate, Glycero phosphate, P-nitrophenyl phosphate, Phenolphthalein phosphate.

Assay of the activity of commercial and lake alkaline phosphatases with six substrates shows dependence on type and concentration of substrate, and also on phosphate concentration, temperature, and pH. The most suitable substrate for phosphatase activity measurement in lake water is 4-methylumberlliferyl phosphate (4-MUP). The other fluorgenic substrate, 3-0-methylfluorescein phosphate (3-0-MFP), is also very sensitive (and therefore also has lower incubation time), but problems may occur with competitive inhibition by phosphate. Phosphatase activity is mostly used to detect phosphorus limitation of phytoplankton. Determination is carried out by adding an artificial substrate and then measuring the hydrolysis product. In this study the enzyme affinity of chromogenic and fluorogenic substrates was tested at a field laboratory at Lake Erken, Sweden. Phosphatase from Escherichia coli was purchased, and lake phosphatases were obtained from concentrated net plankton. The other substrates were 1-naphtol phosphate, glycero phosphate, p-nitrophenyl phosphate (p-NPP), and phenolphthalein phosphate. Phenolphthalein-P and glycero-P showed lower affinity to the phosphatases than the other four. In lake waters enzymatic liberation of phosphate is probably limited by the amount of substrates rather than by phosphatase activity, so that the natural hydrolysis rate cannot be estimated from measurements of the latter. (Lynch-Wisconsin)
W79-09017

PROPERTIES OF AN AQUATIC MICRO-ECOSYSTEM: III. DEVELOPMENT OF THE DECOMPOSER SUBSYSTEM AND THE PHOSPHORUS OUTPUT STABILITY,

Amsterdam Univ. (Netherlands). Lab. of Animal Physiology.
K. Bruning, R. Lingeman, and J. Ringelberg.

In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1231-1235. 3 fig, 7 ref.

Descriptors: *Degradation(Decomposition), *Phosphorus, *Dissolved inorganic phosphorus, *Buffering, *Experimental ecosystems, *Research equipment, Nutrients, Iron, Algae, Autotrophy, Herbivores, Trophic level, Aluminum, Equilibrium, Biological communities, Inorganic compounds, On-site investigations.

The development and steady-state properties of the decomposer subsystem of an experimental microecosystem (M.E.S.) is described, as well as tests of hypotheses regarding the nature of the phosphate buffering mechanism. The M.E.S., consisting of autotrophs (algae), micro-herbivores, and decomposers in separate but connected aquaria, was constructed in spring 1973; this report covers days 180-1067. The subsystem, kept in total darkness, contains a homogeneous layer of water on a bed of sand and gravel. Input water comes from the herbivore unit, and output goes to the autotrophs. Algal biomass fluctuated strongly for about 100 days after day 180. During peak periods dissolved inorganic phosphorus (DIP) concentrations were low in the algal subsystem, and with a small herbivore population, the DIP concentration of decomposer input was almost zero. At low algal levels input as well as output DIP concentrations were high. A less-fluctuating DIP output of the decomposer unit was evident by day 490, followed by a gradual decrease to about day 630, a gradual increase to 105 mu-g P/l on day 770, until these experiments were begun on day 995. The latter demonstrated an evolving mechanism buffering the inorganic phosphorus output of the decomposer unit. Negative DIP production during days 1044-48 following and injection of DIP indicates a true retention mechanism. (Lynch-Wisconsin)
W79-09018

COMPARISON OF SUCCESSIONAL CHANGES IN CHLOROPHYLL LEVELS IN SIMPLE ECOSYSTEMS HAVING DIFFERENT AMOUNTS OF PHOSPHORUS,

Toledo Univ., OH. Dept. of Biology.
P. C. Fraleigh.

In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1236-1242. 3 fig, 21 ref. AEC AT(38-1)-310.

Descriptors: *Chlorophyll, *Ecosystems, *Experimental ecosystems, *Hot springs, *Phosphorus, *Succession, *Yellowstone National Park(WY), Limiting factors, Nutrients, Ecology, Biological communities, Biomass, Standing crops, Cyanophyta, Light, Indicators, Algae, Phytoplankton, Primary productivity, Wyoming, Regulation, Mastigocladus laminosus, Rotifers, Ostracoda.

Experimental flask ecosystems with different phosphorus content, and two wooden troughs constructed in Yellowstone National Park's Lower Geyser Basin (Wyoming) and receiving water from a hot spring, were used to study environmental regulation of aquatic ecosystem community succession, specifically the effects of nutrient limitation on: (1) succession, (2) changes in chlorophyll-a standing crop, and (3) the ratio of chlorophyll to biomass. Conclusions: (1) during ecological succession the chlorophyll content of the community maximizes in relation to the quantity of a limiting nutrient; (2) at maturity communities maintain maximum standing crops of chlorophyll-a; (3) in flow-through ecosystems there is no direct nutrient control of maximum chlorophyll standing crop, which is determined by biomass and light; and (4) successional changes in the chlorophyll:biomass ratio are an indicator of relative nutrient limitation, decreasing when nutrient limitation is significant and increasing when it is not. The microcosm community, taken from a sewage oxidation pond, consisted of the algae Chlorella sp., Schizothrix calciola, and Scenedesmus sp.; Paramecium sp; the rotifers Lepadella sp. and Philodena sp.; and the ostracod Cypridopsis vidua. Thermal spring water was dominated by the cyanophyte Mastigocladus laminosus, and was piped to the troughs at 30 l/min or 15 l/min. (Lynch-Wisconsin)
W79-09019

PE--A NEW REDOX CONCEPT, ITS APPLICATION AS AN INTENSIVE SELFPURIFICATION PARAMETER,

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T. Frevert.

In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1243-1247. 4 fig, 12 ref.

Descriptors: *pe, *Oxidation-reduction potential, *Self-purification, *Mettma Stream(West Germany), *Streams, *Indicators, *Measurement, Electrons, Electrodes, Methodology, West Germany, Hydrogen ion concentration, Dissolved oxygen, Water chemistry, Wastewater disposal, Breweries, Water pollution effects, Chemical oxygen, Demand, Nitrogen, Ammonium, Nitrites, Nitrates, rH.

A new oxidation-reduction concept, pe, is applied as an intensive self-purification parameter for the mean redox-chemical energy level of polluted water. Based on the Nernstian redox concept, other authors proposed rH and pE to supplement the Nernstian redox potential Eh. To distinguish a constant mixed pE from equilibrium pE, the former is written in lower-case letters. It is proportional to the midpoint potentials and the exchange current densities of the potential-determining redox couples, and is dependent on the nature of the involved redox couples, their electrode kinetics, and the condition of a stationary but not necessarily equilibrium state between them. It is a measurement of electron activity as seen from the electrode. In the field application, pe measurements were made 1976-77 in brewery-wastewater-polluted Mettma Stream in West Germany's Black Forest. The rH/pH technique was used with an inert electrolyte-bridged reference electrode. Parameters analyzed were oxygen, ammonium-nitrogen, nitrite-nitrogen, nitrate-nitrogen, S(II) sub T, COD, and BOD2. Results showed that the wastewater input (COD up to 143 mg equiv/l at Station 1) was eliminated by dilution and biological activity by Station 8, and areas of oxygen deficit varied with respect to COD. Self-purification in the stream can be seen as a successive change in the balance between the rise in electron activity (change in pe) and its elimination by oxidative reactions (pOD). (Lynch-Wisconsin)
W79-09020

PHOTOLYTIC CHANGES IN DISSOLVED HUMIC SUBSTANCES,

Wisconsin Univ.- Madison. Dept. of Botany.
D. J. Strome, and M. C. Miller.

In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1248-1254. 3 fig, 2 tab, 17 ref.

Descriptors: *Ultraviolet radiation, *Bacteria, *Humus, *Degradation(Decomposition), *Photoly-

sis, *Dissolved solids, *Shortwave radiation, *Longwave radiation, Organic matter, Alaska, Ponds, Barrow(AK), Carbon, Arctic, Cold regions, Light, Soil bacteria, Soils, Particle size, Molecules, Size, Indicators, Cleavage.

Ultraviolet light was much more effective than bacteria in degrading dissolved humic substances in laboratory bottle experiments on soil humics and in field studies in arctic coastal ponds at Barrow, Alaska. There was evidence that cleavage by UV light is an important first step in microbial decomposition of soluble humic substances; bacteria were able to utilize humic photolytic products for growth and were able to reduce humic absorbance to some extent. An unexpected finding, that shortwave/longwave absorbance ratios increase with photolysis and are unaffected by bacteria, may provide a sensitive means of following the process of humic decomposition. It has been proposed that shortwave absorbance represents high-energy charge-transfer reactions in small molecules or loosely polymerized groups, and longwave absorbance represents low-energy excitations in larger, more highly polymerized molecules. This suggests that humic absorbance ratios increase with exposure to UV light because larger molecules are more susceptible to photolysis. Bacteria may cause absorbance ratios to decrease by preferentially attacking smaller molecules. Absorbance ratios may differ greatly for humics from different sources, but within a watershed there are likely to be minimum ratios from humics freshly leached from soil into a water body. Ratios should increase as photolysis proceeds, with a decrease in average molecular size. (Lynch-Wisconsin)
W79-09021

A THEORETICAL EXPRESSION FOR RESUSPENSION APPLIED TO SEDIMENTATION PROCESSES IN LAKES,
Battelle-Pacific Northwest Lab., Richland, WA. Ecosystems Dept.
R. M. Emery.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1255-1258. 1 fig.

Descriptors: *Lakes, *Resuspension, *Sedimentation, *Sediments, *Mathematical models, *Theoretical analysis, Model studies, Extinction, Particulates, Sediment traps, Equations, Sediment transport, Deposition(Sediments).

The magnitude of combined sediment resuspension forces is analyzed theoretically by means of a sediment trap and an extinction model to quantify either the forces of resuspension or the amount of material resuspended. However, the approach is not proposed to explain resuspension mechanics; any force or combination of forces which do not act directly downward are considered responsible for resuspension. A sediment trap is postulated to contain collection regions S and R, the latter covered by a baffle mounted above it. Point A separates the two regions. In the absence of any resuspension forces, all sedimenting particles would be deposited in region S, assuming particle shape permits a truly vertical descent, (the contrary case is also discussed). Resuspension forces would result in particle deposition in region R, with the distance past point A into region R dependent on the strength of the forces. Since region S contains particles which were directly sedimented plus resuspended ones, the concentration of particles in region S (C sub s) serves as a control for evaluating the quantitative extent of lateral displacement into region R. The concentration gradient region R (C sub r) can be expressed by the extinction equation C sub r = C sub s times e to the -kd power (k = extinction coefficient, d = distance from point A). Expressions are given for the magnitude of resuspension and the resuspension coefficient. A sediment trap is suggested for determining the resuspension coefficient k sub r. (Lynch-Wisconsin)
W79-09022

VIRUS-LIKE PARTICLES ISOLATED FROM DIFFERENT POPULATIONS OF AQUATIC GASTROPODS,
Davidson Coll., NC.
W. T. Lammers.
In: Proceedings: 20th Congress, Internatioale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1259-1263. 4 fig, 1 tab, 7 ref.

Descriptors: *Gastropods, *Viruses, *Water pollution effects, *Bioaccumulation, *Streams, *Salt marshes, Spartina, Physa inflata, Melampus bidentatus, Littorinia irrorata, Nesseria obsoletus, Snails, Sapelo Island(GA), Georgia, Rocky River watershed(NC), North Carolina, Rivers, E. coli, Marshes, Optical density, Density, Colloids, Fractionation, Particle size, Centrifugation, Methodology.

Four species of aquatic gastropods were collected from polluted and unpolluted sites in North Carolina and Georgia to study their accumulation of virus-like particles. Three major optical density peaks were found for the freshwater pulmonate snail, Physa inflata, reflecting varying levels of pollution stress in the Rocky River watershed North Carolina. The peaks are: (1) 1.01-1.05 gm/cc, present at all sites but one, and especially well-developed at the most stressed stations; (2) 1.11-1.16 gm/cc, present at all stations, but best developed regarding size and UV fluorescence at the more heavily stressed stations; and (3) 1.2-1.23 gm/cc, obvious only at the three most stressed stations. Little change in density or size of particle peaks was found for the three Spartina salt marsh species between polluted and unpolluted sites on Sapelo Island, Georgia and near Wrightsville Beach, North Carolina. P. inflata is thus a good choice for this type of study, due to its high pollution tolerance and the differences in accumulation of virus-like particles according to changes in the quality and quantity of the particles in the stream. In the salt marsh, the species (Melampus bidentatus, Littorinia irrorata, and Nesseria obsoletus) do not show similar variations in particle accumulation. In the marshes the virus-like particles may flocculate out of suspension as salinity increases. Particle peaks existing in all samples may represent normal tissue viruses, while variable peaks may represent particles accumulated from the water. (Lynch-Wisconsin)
W79-09023

SEPARATION OF ALGAE AND BACTERIA IN LAKE WATER BY SIZE FRACTIONATION,
Lund Univ. (Sweden). Limnological Inst.
M. F. Coveney.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1264-1269. 2 fig, 2 tab, 12 ref.

Descriptors: *Bacteria, *Phytoplankton, *Fractionation, *Particle size, *Filters, *Particle shape, Algae, Size, *Research equipment, Filtration, Membranes, Whatman GF/C filters, Nuclepore filters, Chlorophyll, Cellulose ester membrane filters, Glass fiber filters, Fluorescence, Eutrophication, Lake Bysjon(Sweden), Sweden, Lakes.

The Whatman GF/C glass fiber filter (no defined pore size) is somewhat superior to the three mu-m Nuclepore cellulose ester membrane filter for separating phytoplankton and bacteria in lake water by size fractionation. Surface water samples from eutrophic Lake Bysjon, southern Sweden, were fractionated on seven occasions with the GF/C filter and twice with the Nuclepore filter 1975-76. Bacterial number was verified by direct epifluorescence counting techniques, and algal biomass by microscopic inspection and photometric and fluorometric chlorophyll-a determinations. The two filters are about equally effective in allowing bacteria to pass through, about 70-90% with a volume of 10 ml and 50-60% with 20 ml. The GF/C filter retains almost 100% of total algal biomass, however, compared with 99.4-99.5% for the Nuclepore filter. For small algal cells, the GF/C filter retains all of the 4 x 2 mu-m Phormidium mucicola cells, while the Nuclepore filter retains 89-91%, and the GF/C filter retains 97% of spherical cells of about two mu-m diameter, compared with 44% (10 ml) to 57% (20 ml) with the Nuclepore filter. Retention of algal biomass on the Nuclepore filter is therefore affected by size distribution. It is possible that most of the bacteria not passing through the filters are attached to larger particles, though variations according to volume filtered indicate the influence of other factors, perhaps filtering by seston accumulating on the filter. (Lynch-Wisconsin)
W79-09024

LOSS OF A CRITICAL SPECIES IN A MODEL (LABORATORY) ECOSYSTEM,
Washington Univ., Seattle. Coll. of Fisheries.
F. B. Taub, and M. E. Crow.
In: Proceedings: 20th Congress, International Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1270-1276. 2 fig, 2 tab, 7 ref.

Descriptors: *Experimental ecosystems, *Daphnia magna, *Bioassay, *Toxicity, *Acetone, *Biochemical oxygen demand, *Laboratory tests, Water pollution effects, Research equipment, Cladocera, Algae, Chlamydomonas reinhardti, Biological communities, Poisons, Dissolved oxygen, Ecosystems, Ecology, Protozoa, Tetrahymena vorax, Philodina, Cyridopsis vidua, Rotifers, Bacteria, Serratia marcescens, Nutrients, Phosphates, Nitrates.

The cladoceran Dephnia magna was eliminated from biological communities in 77 of 120 experimental laboratory ecosystems because acetone was used as a solvent for toxicants in bioassays. The presence or absence of Daphnia affects virtually all measurements taken in the microcosms; the loss of one species can have ecosystem-level effects, with both statistical and biological implications. Attempts to statistically analyze data must account for such a divergence among 'replicates' in a study subject to these indirect effects. Biologically, effects on the whole community by loss of one species must be considered. Daphnia processes algal cells into a form more favorable for ostracods and bacteria, resulting in more effective recycling. During bioassays half the microcosms received acetone only and the other half acetone plus toxicants. The Daphnia populations were equally affected by both applications, probably a result of a temporary decrease in oxygen concentration caused by the acetone. In another set of experiments with distilled water as the solvent, Daphnia in only one of 120 microcosms was eliminated. Whereas organic carriers may not be directly toxic to organisms, they may represent an additional organic nutrient to microbes and a BOD stress. Daphnia extinction could probably have been avoided either by inoculating the algal component several days prior to the invertebrates and toxicants, or reinoculation of Daphnia after the acetone addition. (Lynch-Wisconsin)
W79-09025

STUDIES OF THE QUANTITATIVE ESTIMATION OF NATURAL POPULATIONS OF SMALL GREEN ALGAE,
University Coll. of North Wales, Bangor. School of Plant Biology.
C. M. Happey-Wood.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1277-1284, 3 fig, 5 tab, 12 ref.

Descriptors: *Chlorophyta, *Estimating, *Counting, *Methodology, *Agar plates, *Inverted microscopes, *Testing procedures, Microscopy, Distribution, United Kingdom, Motility, Chlorella pyrenoidosa, Chlamydomonas debaryana, Abundance, Culture media, Size, Ponds, Density, Cultures.

Two methods of counting nonmotile and motile small chlorophytes--(1) the inverted microscope technique, and (2) the agar plate culture technique--gave results which differed significantly

only at extreme population densities. At high densities, greater counts with the inverted microscope are probably due to counting very large numbers of small cells. The agar plate technique is therefore sufficiently accurated for estimation of population densities of small green algae. Problems resulting from heterogeneous distribution of the algae in lake water or on sediments far outweight the slight variability attributable to the plate counting technique, however, and this heterogeneity requires consideration in algal studies. The experiments used Chlorella pyrenoidosa and Chlamydomonas debaryana to compare the two techniques. Variability found among sub-samples in the case of the motile Chlamydomonas suggests a less-even distribution of these algae in the experimental culture than with the nonmotile Chlorella, despite constant shaking between subsampling. No significant movement of motile cells occurs on the agar plates. Significant zoospore release on the plates results in numbers estimated by this method being consistently higher than with the inverted microscope. The least accurate counts were at low population densities of both algae. (Lynch-Wisconsin)
W79-09026

METHODS OF THE REPRESENTATIVE ANALYSIS OF DIATOM COMMUNITIES,
Zaklad Algologii, Lodz (Poland).
J. Z. Kadlubowska.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1285-1288, 2 tab, 4 ref.

Descriptors: *Diatoms, *Methodology, *Analytical techniques, *Microscopy, *Testing procedures, *Equations, Randomness, Algae, Chrysophyta, Mud, Sampling, Species composition, Abundance, Biological communities, Limnology, Lakes, Rivers.

Methods are described for ensuring that microscopic determinations of diatom community species composition and abundance in water or mud samples are truly representative. The number of fields on a 20 X 20 mm cover glass varies greatly depending on the power of the microscope objective, ranging from 280 at 10X to 20,400 at 90X with a standard microscope. The fields analyzed must be selected at random; the following procedure is recommended: (1) four corners of the cover glass are determined on the longitudinal (horizontal) and transversal (vertical) scales of the microscope cross-table, and designated a, b, c, d; (2) a-b and c-d, each 20,000 mu-m long, are divided into 100 sectors, each 200 mu-m long; and (3) a table is constructed (illustrated) to facilitate random selection, based on the principle that the first number chosen gives the position of a field on the horizontal scale, the second on the vertical scale, etc. A separate table must be prepared for each objective. By this method both the number of taxa per sample and the quantity of diatom cells in a given volume can be calculated. Steps involved: (1) prepare a sample of known volume and dilution, (2) enumerate diatom cells in the random fields, (3) calculate meand cells/field and standard error of the arithmetic mean (equations provided), (4) determine the confidence limit, and (5) calculate average cells/ml water or cu cm mud. An equation is also given for calculating the numerical force of the sample. (Lynch-Wisconsin)
W79-09027

DETERMINATION OF SEASONAL PHYTOPLANKTON COMMUNITIES, BASED ON QUANTITATIVE DATA, USING A MATHEMATICAL ANALYSIS,
Ghent Rijksuniversiteit (Belgium).
A. Caljon.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1289-1292. 3 fig, 12 ref.

Descriptors: *Mathematical studies, *Principal component analysis, *Phytoplankton, *Seasonal, *Analytical techniques, *Species composition, *Population dynamics, Algae, Biological communities, Microscopy, Ditches, Belgium, Standing crops, Ponds, Chlorophyll, Abundance, Water chemistry.

Seasonal phytoplankton communities in a stagnant freshwater pond near Waasmunster, Belgium were determined, using 39 of 162 taxa collected 1972-73. Principal component analysis based on cell number, and the products of cell volume and cell surface with the cell number for each taxon and for each sample, gave results similar to the seasonal analysis for surface and volume values, and slightly different results for cell number. Analysis of physico-chemical data, chlorophyll-a, and standing stock shows a negative correlation. There is a very strong correlation between total cell surface and total cell volume as measures of total dynamics of the 39 taxa, but both indicators show less satisfactory agreement with phytoplankton dynamics phytoplankton expressed as total cell number. Spring community: Diatoma elongatum, D. elongatum var. actinastroides, Euglena proxima, Peridinium palatinum, Dinobryon sertularia, Synedra acus var. radians, Chodatella quadriseta, Merismopedia glauca, Trachelomonas hispida var. crenulatocollis, Chrysococcus minutus, Kephyrion asper, Cyclotella comta, Scenedesmus quadricauda, Bicoeca planctonica, Nephrocytium agardhianum, and Crucigenia quadrata. Summer: Peridinium lomnickii, P. polonicum, P. elpatiewskyi, Cryptomonas erosa, C. ovata, Aphanizomenon flos-aquae, Trachelomonas volvocina, Anabaena planctonica, Gymnodinium rotundatum, Microcystis marginata, and Coelastrum microporum. Autumn: Ceratium hirundinella, Cryptomonas marssonii, C. vurvata, and Oocystis lacustris. Winter: Closterium gracile and Peridinium aciculiferum. (Lynch-Wisconsin)
W79-09028

AN EXPERIMENTAL THREE-STEP BENTHIC FOOD CHAIN,
Zoologisches Inst., Basel (Switzerland).
B. Streit.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1293-1297. 2 fig, 6 ref.

Descriptors: *Testing procedures, *Food chains, *Benthos, *Methodology, *Bioaccumulation, *Carbon cycle, Algae, Limpets, Gastropods, Benthic fauna, Benthic flora, Invertebrates, Leeches, Periphyton, Nitzschia actinastroides, Chrysophyta, Diatoms, Ancylus fluviatilis, Glossiphonia complanata, Pesticides, Tracers, Carbon radioisotopes, Grazing, Predation, Filters, Carbon, Hirudinea, Energy.

A laboratory benthic food chain consisting of a primary consumer, the limpet Ancylus fluviatilis feeding on the periphytic diatom Nitzschia actinastroides, and a secondary consumer, the leech Glossiphonia complanata feeding on the limpet, simulates natural conditions and is suitable for measuring carbon balances and pesticide bioaccumulation. Nitzschia, cultivated in chemostatic or batch cultures, may be used directly or after labelling with Na H14CO3 (uniform labelling) or with carbon-14 labelled pesticides. Biomass per unit volume is determined by measuring light extinction of the suspension at 720 m in a photometer. A defined volume of the suspension is filtered into a cellulose nitrate millipore filter (47 mm diam), washed with tap water, and transferred into an Erlenmeyer flask containing about 100 ml tap water. Algae stop growing and remain firmly attached to the filter. This method does not work with the chlorophyte Scenedesmus or the cyanophyte Anabaena. It is thus possible to offer various concentrations of carbon per surface unit to the snails up to about two mg C/ sq mm. Algae on the filter may be used 3-4 days, then a new filter must be prepared. Oxygen content and pH will not change significantly if the vessel is aerated. Limpet excretions may cause ammonium content to rise. Leeches are added as a third step. Carbon balances are determined by measuring algae planimetrically, animal weight, feces, and egg capsules. (Lynch-Wisconsin)
W79-09029

ANNUAL SEASONAL VARIATION OF PHYTOPLANKTON PRIMARY PRODUCTIVITY AND BIOMASS, CORRELATED WITH PHYSICAL PARAMETERS IN THE OTTAWA RIVER, CANADA,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
A. S. Rosemarin, and J. S. Hart.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1299-1306. 2 fig, 19 ref.

Descriptors: *Seasonal, *Phytoplankton, *Biomass, *Primary productivity, *Water temperature, *Ottawa River(Canada), Rivers, Algae, Physical properties, Canada, Light, Transparency, High flow, River flow, Regression analysis, Discharge(Water), Pulp and paper industry, Municipal wastes, Industrial wastes.

Water temperature, followed by incident radiant energy, are the most important factors determining seasonal variation in phytoplankton primary productivity and biomass in the Ottawa River, Canada, based on regression analysis of 1971-72 data. Primary productivity variation is influenced by phytoplankton biomass variation only after effects of temperature and incident radiant energy are reduced in such calculations. Spring river discharge positively correlates with and is the major negative factor controlling phytoplankton productivity and biomass levels. Low Secchi disk transparency is associated with high river discharge. The 1330-km Ottawa River, which drains an area of 145,000 sq km in eastern Ontario and western Quebec, has mean annual flow of over 1980 cu m/sec near its mouth. The water is soft, low to intermediate in total alkalinity, has a pH of 7.1-7.2, and is brownish due to humic acids. Sampling was carried out near the city of Ottawa 6.5 km downstream from a sulfite paper mill. Phytoplankton productivity ranges from 0.5 mg/C/sq m/day under ice cover to 406 mg/sq m in June, with an integrated annual mean of 57 mg/sq m. A secondary peak occurred in the fall. Fresh-weight biomass ranges from 0.5 mu-g/l in February to 51 mu-g/l in August, with algal cell numbers varying from almost zero in March to 90,000 in late October. Peaks in biomass and cell number occur in fall and summer. (Lynch-Wisconsin)
W79-09030

VARIATIONS IN THE PRODUCTION OF EMERGING INSECTS FROM A QUEBEC STREAM,
Montreal Univ. (Quebec). Dept. of Biological Sciences.
P. P. Harper.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1317-1323. 5 fig, 2 tab, 9 ref.

Descriptors: *Insects, *Emerging insects, *Streams, *Benthic fauna, *Productivity, Quebec(Canada), Canada, L'Achigan River Basin(Quebec-Canada), Rivers basins, Tributaries, Food webs, Growth stages, Invertebrates, Secondary productivity, Carnivores, Riffles, Filter feeders, Diptera, Odonata, Ephemeroptera, Plecoptera, Chironomidae, Tricoptera, Tanytarsini, Simuliidae, Habitats, Baseline studies.

Production of insects emerging from a second-order stream in the l'Achigan River system, Quebec, Canada, was studied from the May thaw to autumn in 1972 and 1973 to supplement existing data on benthic production, which is usually limited to that passing directly into the aquatic food web. The 500-m stream contains three shallow riffle areas and two deeper pools, and is 1-5 m wide. Discharge varies 80-1000 l/sec, with a maximum velocity of 100 cm/sec. Some 257,771 insects were collected with pyramidal emergence traps, identified for species except the chiromid groups Orthocladiinae and Tanytarsini, and dry wt estimated. The 17 stations produce 9,118-48,300 indiv/sq m/yr, with upstream sections of riffles the most productive due to a prevalence of filter feeders,

pools the least productive, and lower riffle areas intermediate. The highest weight recorded was 15.37 g/sq m (Station 5), higher than reported for any previous studies; high production is inversely related to percentage of carnivores. Diptera dominate in all habitats except two stations dominated by Plecoptera and one each by Ephemeroptera and Odonata. High Diptera levels at Stations 3-5 are due to emergence of blackflies (Simuliidae), and at Station 14 by Tanytarsini. A total of 243 species have been identified so far including 119 Diptera, 60 Trichoptera, 24 each of Ephemeroptera and Plecoptera, and 11 Odonata. Higher weights were recorded in 1973 than 1972, presumably related to much lower discharges in 1973. (Lynch-Wisconsin)
W79-09031

PATTERNS OF NITROGEN UPTAKE AND LOSS IN RELATION TO LITTER DISAPPEARANCE AND ASSOCIATED INVERTEBRATE BIOMASS IN SIX STREAMS OF THE PACIFIC NORTHWEST, U.S.A.,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
F. J. Triska, and B. M. Buckley.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1324-1332. 5 fig, 2 tab, 20 ref.

Descriptors: *Nitrogen, *Litter, *Needles, *Invertebrates, *Degradation(Decomposition), *Streams, *Absorption, Biomass, Washington, Oregon, Mountains, Pacific Northwest U.S., Leaves, Microorganisms, Ecosystems, Ecology, Carbon, Productivity, Decay coefficient, Limiting factors, Leaching, Nutrients, Flynn Creek(OR), Needle Branch Creek(OR), Mack Creek(OR), WS 10(OR, Experimental Spring(WA).

Study of needle leaf litter processing in six streams in Oregon and Washington shows that the capacity of litter microflora to mediate nitrogen uptake and release may directly influence production of litter-consuming invertebrates in lotic ecosystems. Previous studies in streams of the area indicate that if any nutrient limits biota associated with litter, it is nitrogen. Despite a five-fold variation in the decay coefficient among the streams, a qualitatively similar pattern of nitrogen uptake and release was observed, characterized by large leaching loss followed by nitrogen gain presumably related to microbial colonization. All streams gain nitrogen sometime during decomposition, resulting in a nitrogen sink for the ecosystem, and a source of nitrogen to litter-consuming invertebrates. Highest invertebrate biomass is associated with packs of needle litter when the carbon-nitrogen ratio is lowest, notably in Needle Branch Creek where the lowest C/N ratio is observed. Four of the streams are located in two Oregon mountain areas, the Coast Range (Flynn Creek and Needle Branch Creek) and Cascade Range (Mack Creek and WS 10). The other two streams, man-made, are fed by a large spring at the Experimental Spring site in southwest Washington. Needle litter was dried at 50 C, strung on nylon line to form 5-15 g packs, and anchored in streams with bricks. Stream habitats ranged from completely exposed to densely canopied. (Lynch-Wisconsin)
W79-09032

PRESENCE AND ECOLOGICAL ROLE OF NITROGEN-FIXING BACTERIA ASSOCIATED WITH WOOD DECAY IN STREAMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
B. M. Buckley, and F. J. Triska.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1333-1339. 2 fig, 3 tab, 20 ref. NSF DEB-74-20744A02.

Descriptors: *Degradation(Decomposition), *Wood, *Streams, *Nitrogen fixing bacteria, *Nitrogen fixation, WS 2(OR), Oregon, Cascade Mountains(OR), Forest watersheds, Litter, Trees, Douglas fir trees, Acetylene reduction, Mountain forests, Enzymes, Nitrogenases, Enterobacter agglomerans, Pseudotsuga menziesii, Substrates, Ecology, Bacteria, Bark, Pacific Northwest U.S.

The potential role of nitrogen fixation on old-growth wood debris was investigated in a second-order stream, Watershed 2 (WS 2), in the H.J. Andrews Experimental Forest in Oregon's Cascade Mountains. Results show that nitrogen fixation may play an important role both in decomposition of wood in lotic systems and in the nitrogen economy of Pacific Northwest old-growth forest streams. The forest is dominated by virgin stands of Douglas fir (Pseudotsuga menziesii), which contribute large amounts of wood to the terrestrial and aquatic environments. Four substrates were tested March 1975-May 1976 with acetylene reduction: twigs, bark, chips, and blocks. Substrates were dried at 50 C, weighed, placed into nylon mesh litter bags, incubated in the stream, and removed seasonally. Some nitrogenase activity was observed in all four types, with highest rates of acetylene reduction associated with twigs and chips, probably due to higher surface-to-volume ratios. Denser blocks and bark showed lowest rates. Reduction rates were generally highest during warmest months (April-September). Major seasonal differences are attributed to temperature, as the nitrogenase enzyme system is inhibited by colder temperatures (especially below five C). H-tube isolations in dilution series generally confirm field data. Isolates from field samples in selective media likewise confirm the presence of nitrogen-fixing organisms, including Enterobacter agglomerans, a terrestrial nitrogen-fixing bacterium on wood. (Lynch-Wisconsin)
W79-09033

PHOSPHORUS DYNAMICS ON ORGANIC AND INORGANIC SUBSTRATES IN STREAMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
S. V. Gregory.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1340-1346. 4 fig, 2 tab, 6 ref. NSF DEB-74-20744A02.

Descriptors: *Phosphorus, *Streams, *Leaves, *Substrates, *Absorption, *Biological communities, Benthic flora, Dynamics, Nutrients, Needles, Sediments, Retention time, Algae, Berry Creek(OR), Mack Creek(OR), Epilithic, Periphyton, Aquatic plants, Detritus, Prasiola, Petasites frigidus, Chlorophyta, Zygnema, Maple trees, Alder trees, Oregon, Cascade Mountains(OR), Litter, Forest watersheds, Pacific Northwest US.

Physical and biological processes of phosphorus sorption onto organic and inorganic stream substrates were investigated with rocks and leaf bags in various streams in the H.J. Andrews Experimental Forest in the Cascade Mountains of Oregon. Data indicate sorption of phosphorus onto substrates is predominately a biological process regulated by the quantity of benthic algae, bacteria, and fungi. Volcanic rock samples, conifer needles, and bigleaf maple and alder leaves were used in the tests, and orthophosphate absorption by the primary producers Zygnema sp (a filamentous green alga), Prasiola sp. (a monostromatic sheetlike green alga), and Petasites frigidus (a herbaceous plant) was monitored. Physical sorption was generally less than 20% of phosphorus translocation onto benthic substrates. Major physical factors affecting phosphorus uptake are those enhancing retention time of stream water, including gradient, debris dams, and channel roughness. Higher retention time augments the time available for the biota to remove phosphorus in solution. Detritus quality is important in determining phosphorus uptake potential; more refractory organic matter such as conifer needles or highly lignified, fine organic matter cannot support as much microbial metabolism as more labile materials such as alder or maple leaves. Phosphorus uptake increases with the length of time the leaf material has been in the stream. Thin-layered epilithic algal communities had highest phosphorus absorption rates among autotrophs. (Lynch-Wisconsin)
W79-09034

ECOLOGICAL EFFECTS OF FOREST FERTILIZATION WITH UREA ON SMALL WESTERN CASCADE STREAMS OF OREGON, U.S.A.,
Corvallis Environmental Research, Lab., OR.
F. S. Stay, K. W. Malueg, R. E. Austin, M. R. Crouse, and A. Katko.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1347-1358. 8 fig, 2 tab, 15 ref.

Descriptors: *Urea, *Fertilization, *Streams, *Environmental effects, *Water pollution effects, *Nitrogen, Ecology, Invertebrates, Fish, Rainbow trout, Salmo gairdneri, Nitrates, Nitrites, Ammonia, Algae, Algal growth potential, Limiting factors, Buffering, Nutrient loading, Bioassay, Water chemistry, Cascade Mountains(OR), Oregon, Forest watersheds, Mountain forests, Pacific Northwest US, On-site investigations.

Urea fertilization of a 1926-ha stand of second-growth Douglas fir in Oregon's Cascade Mountains in April 1976 did not significantly affect organisms in area streams during a study conducted March-December 1976. Unfertilized buffer strips 30-45 m wide were maintained on both sides of five creeks, and two creeks in unfertilized areas served as controls. Urea was applied by broadcasting agricultural-grade prills 1-2 mm in diameter from a helicopter at about 225 kg N/ha. Conclusions: (1) violation of buffer strips temporarily elevated nitrogen levels in streams immediately following fertilization, (2) high nitrogen concentrations in Seventh Creek were probably due to fertilization of its unbuffered headwater streams, (3) the width of the buffer strips (30 vs 45 m) did not affect nitrogen loading to streams, (4) algal assays showed no significant change in algal growth potential, (5) no changes observed in macroinvertebrate populations of the streams could be conclusively attributed to fertilization, and (6) fish assays with rainbow trout (salmo gairdneri) showed no mortalities due to fertilization. Drift net macroinvertebrate samples showed a peak in abundance (particularly dipterans and ephemeropterans) at the beginning of fertilization, but during the later period of most intense fertilization no such peak was observed. Diversity index values occasionally indicated perturbation, but such episodes occurred both before and after fertilization. (Lynch-Wisconsin)
W79-09035

AN IMPROVED DESIGN FOR ASSESSING IMPACTS OF WATERSHED PRACTICES ON SMALL STREAMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
J. D. Hall, M. L. Murphy, and R. S. Aho.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1359-1365. 1 fig, 2 tab, 15 ref. NSF DEB-74-20744A02.

Descriptors: *Methodology, *Environmental effects, *Watershed management, *Lumbering, *Streams, *Fish, *Analytical techniques, Land use, Evaluation, Watersheds(Basins), Forest watersheds, Ecosystems, Salmanders, Coho salmon, Oncorhynchus kisutch, Cutthroat trout, Salmo clarki, Dicamptodon ensatus, Pacific giant salamander, Mountain forests, Oregon, Cascade Mountains(OR), Statistical methods.

Comparative evaluation of four approaches for assessing effects of watershed management practices (such as logging and grazing) on stream ecosystems indicates that extensive post-treatment analysis with paired-site comparisons provides the most useful information. Other approaches: (1) conventional long-term, or intensive before-after, study; (2) extensive before-after comparison; and (3) intensive post-treatment analysis. All four methods have been used in Oregon in recent years to evaluate effects of logging on coho salmon (Oncorhynchus kisutch), cutthroat trout (Salmo clarki), and the Pacific giant salamander (Dicamptodon ensatus). The extensive post-treatment approach, by studying a wide array of watersheds

treated in different ways or at different times in the past, permits assessment of either or both serverity of effects of various treatments and length of time an effect may persist. Use of paired-site comparisons often reduces variance and significantly increases precision. Pairing is most applicable in cases of localized impacts, however, and may not be as effective where general effects over whole watersheds are involved. In such cases a combined extensive-intensive approach with paired-site comparisons in both is recommended. A disadvantage of the technique is relatively high cost concentrated in a short period (2-3 years). Results of long-term studies are difficult to evaluate because of natural variations. Generalized nonparametric tests should replace parametric ones since the very small sample size of most watershed studies casts serious doubt on the assumption of normality. (Lynch-Wisconsin)
W79-09036

TRANSPORT OF PARTICULATE ORGANIC MATERIAL IN STREAMS AS A FUNCTION OF PHYSICAL PROCESSES,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
J. R. Sedell, R. J. Naiman, K. W. Cummins, G. W. Minshall, and R. L. Vannote.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1366-1375. 3 fig, 2 tab, 15 ref. NSF BMS-75-0733.

Descriptors: *Sediment transport, *Particulate organic matter, *Streams, *Stream power, *Rivers, *Particle size, Organic matter, Very fine particulate organic matter, Oregon, Idaho, Michigan, Pennsylvania, Detritus, Watersheds(Basins), River basins, Channel morphology, Streambeds, Streamflow, Gradients(Streams), Physical properties, Indicators.

Examination of particulate organic matter (POM) transport in 16 streams and rivers of different sizes located (four each) in Oregon, Idaho, Michigan, and Pennsylvania shows: (1) very fine particulate organic matter (VPOM) dominate POM transport in all streams sizes in all regions during all seasons, and (2) unit stream power is a theoretically sound physical variable against which to study particulate transport. Stream power includes concepts of water density, rate of discharge, and stream gradient. Since organic particulates do not behave like inorganic sediments due to lower specific gravity and higher surface-to-volume ratios, further scaling of unit stream power with retention indices (the ability of the system to store POM) would provide a better index of POM transport. The highest POM levels and largest concentration ranges are in Michigan streams, with mean concentrations ranging from 4757 mg/cu m in the Kalamazoo River to 7126 mg/cu m in upper Augusta Creek. Idaho streams show greatest annual variation in concentration, and Oregon streams transport the least POM (almost an order of magnitude below the other regions) and have narrow annual ranges. Exported POM have a mean diameter of 5-12 mu-m in all streams, though type and amounts of organic inputs vary greatly. Most transport is in the VPOM range; therefore, gradient, unit stream power, and watershed area are particularly important since VPOM is easily suspended and is less influenced by streambed roughness or stream retention characteristics. (Lynch-Wisconsin)
W79-09037

DIVERSITY IN STREAM INSECTS: REGULATION BY ROCK SIZE AND MICROSPATIAL COMPLEXITY,
California Univ., Davis. Div. of Environmental Studies.
D. D. Hart.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1376-1381. 2 fig, 4 tab, 18 ref.

Descriptors: *Rocks, *Size, *Shape, *Species diversity, *Species richness, *Insects, Habitats, Substrates, Regulation, Colonization, Sagehen Creek(CA), California, Ephemeroptera, Plecoptera, Tricoptera, Coleoptera, Diversity indices.

Rock size and complexity of shape correlate positively with insect species richness and Shannon-Wiener diversity in an experiment conducted in Sagehen Creek, Sierra County, California. Simulated rocks were made of fired ceramic clay in three shapes, each of two sizes. Twelve replicate sets were each fastened to a 20 x 45 cm board in a consistent pattern, placed in the stream at depths of 25-40 cm at a site containing rocks similar to the replicas, and retrieved after 35 days. Current velocity ranged from 20-40 cm/sec. The six rock types are: (1) large sphere (about 710 sq cm surface area), (2) small sphere (105 sq cm), (3) large cube (547 sq cm), (4) small cube (89 sq cm), (5) large irregular cube (550 sq cm), and (6) small irregular cube (92 sq cm). Only Ephemeroptera, Trichoptera, Plecoptera, and Coleoptera were counted for the study. Within shapes, large rocks hold more species than small, and within sizes, the number of species is greatest on the irregular cubes, intermediate on the cubes, and lowest on the spheres. Equalization of variances show significant differences in mean richness due to both size (p .001) and shape (p .05). Duncan's multiple range test on untransformed data gives similar results, but show indistinguishable means among the three smaller rocks. While richness/area is significantly higher on irregular than spherical rocks, large rocks have significantly less species/area than small. Species richness/rock correlate positively with number of individuals/rock. Increased richness on complex rocks is due to greater resource diversity. (Lynch-Wisconsin)
W79-09038

MACROINVERTEBRATE COMMUNITY STRUCTURE OF FOUR SPECIAL LOTIC HABITATS IN COLORADO, U.S.A.,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
J. V. Ward, and R. A. Short.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1382-1387. 2 tab, 14 ref.

Descriptors: *Insects, *Biological communities, *Bioindicators, *Colorado, *Streams, *Impoundments, Rivers, Regulation, Dams, Environmental effects, Joe Wright Creek(CO), South Platte River(CO), Trout Creek(CO), North Fork(CO), Reservoirs, Irrigation, Epilithic, Rooted aquatic plants, Species diversity, Invertebrates, Ephemeroptera, Trichoptera, Plecoptera, Diptera, Baetis, Brachycentrus, Amphipoda, Alloperla, Ecology.

Macroinvertebrate communities of four dammed Colorado streams were compared to identify taxa useful as indicators of effects of stream regulation. Unregulated portions of the streams served as experiment controls. Stream sites included: (1) Joe Wright Creek below an irrigation reservoir, exhibiting great discharge fluctuations; (2) a spring brook site north of Horsetooth Reservoir, which lacks an upstream source of limnetic seston but has constant conditions similar to some sites below dams; (3) Trout Creek below a surface-release reservoir; and (4) the South Platte River below a deep-release reservoir (Cheesman Lake), which moderates major flow fluctuations. No sites were disturbed except by dams; fauna consist primarily of insects (except in the spring brook), especially Ephemeroptera, Plecoptera, Diptera, and Tricoptera. Most of the fauna can be classified in four groups; (1) euryokous, or tolerant, organisms found in virtually all regulated or unregulated streams, but which may become abundant with certain types of regulation, such as the mayfly Baetis in the South Platte, the spring brook, and Joe Wright Creek; (2) organisms present in unregulated streams and favored by certain types of regulation, such as the stonefly Alloperla in Joe Wright Creek; (3) intolerant organisms present in unregulated streams but reduced or absent in regulated streams, such as the trichopteran Brachycentrus; and (4) organisms not normally present in unregulated mountain streams, but characteristic of regulated streams, such as amphipods in Trout Creek, the South Platte, and the spring brook. (Lynch-Wisconsin)
W79-09039

ENERGETIC EVALUATION OF A STREAM ECOSYSTEM AFFECTED BY COAL MINE DRAINAGE,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
W. J. Mitsch, M. A. McPartlin, and R. D. Letterman.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1388-1395. 2 fig, 4 tab, 32 ref.

Descriptors: *Energy, *Mine drainage, *Ben's Creek(PA), *Trophic level, *Fish, *Invertebrates, *Water pollution effects, *Analytical techniques, Coal mines, Streams, Pennsylvania, Benthic fauna, Insects, Sculpin, Cottus bairdi, Brown trout, Salmos trutta, Biological communities, Mortality, Food habits, Biomass, Ecosystems, Energy quality.

Energetics is assessed with a simplified methodology in Ben's Creek, a small fourth-order stream in western Pennsylvania near Johnstown polluted by acid drainage from an abandoned coal mine. The trophic level and energy quality approaches are employed; the latter, which gives higher energetic value to organisms at higher trophic levels, includes important concepts for evaluating stream energetics. Benthic macroinvertebrates and fish dominate consumers; terrestrial insects, detritus, and primary producers round out the energy flow diagram. Sculpin (Cottus bairdi) and brown trout (Salmo trutta) are particularly important fish. The stream is dependent primarily on allochthonous organic matter, but primary producers are included as forcing functions. Sampling during summer 1976 showed invertebrate biomass declined 87% downstream of the mine drainage compared with the upstream value, and fish biomass declined 95%. Total productivity upstream is estimated at 573 cal/sq m/day for invertebrates and 1020 cal/sq m/day for fish. The imbalance may be due to sampling inefficiency, high insect emergence in summer, and fish migration upstream. Energy quality calculations assume detritus to have an energy quality factor of 1.0. Values increase with increasing trophic level. The higher quality animals seem to suffer a higher mortality rate as a result of the mine drainage; stress reduces diversity by removing the stabilizing representatives of higher trophic levels. (Lynch-Wisconsin)
W79-09040

ROLE OF DETRIVORE SELECTIVITY IN SPECIES-SPECIFIC LITTER DECOMPOSITION IN A WOODLAND STREAM,
North Carolina Univ. at Chapel Hill. Dept. of Zoology.
S. R. Reice.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1396-1400. 2 fig, 2 tab, 10 ref. NSF bms 74-15332.

Descriptors: *New Hope Creek(NC), *Leaves, *Insects, *Degradation(Decomposition), *Detritus, *Selectivity, Specialization, Food habits, Streams, North Carolina, Detritovores, Litter, Biomass, Ecosystems, Biological communities, Forest watersheds, Trees, Chironomidae, Oligochaetes, Hydracarina, Carya tomentosa, Cornus florida, Fagus grandifolia, Fraxinus americana, Liquidambar styraciflua, Liriodendron tulipifera, Oxydendrum arboreum, Platanus occidentalis, Quercus alba, Quercus rubra, Acer rubrum.

Although there is no overall specialization pattern of detritivorous insects according to leaf decomposition rates in New Hope Creek, North Carolina, insect taxa do specialize individually. These specialists counterbalance one another, resulting in the artificially uniform overall pattern. Leaf packs of 11 local species of deciduous trees were attached to bricks and placed in a stream riffle 2 June 1975.

Triplicate sets were removed on June 3, 4, 9, 16, 23, and 30, leaf packs were weighed, and chironomid larvae, oligochaetes, and Hydracarina were counted. Leaves were classified as to decomposition rate: (1) fast (78-100% biomass loss in 28 days)--Cornus florida (flowering dogwood), Oxydendrum arboreum (sourwood), Fraxinus americana (white ash), and Liriodendron tulipifera (yellow poplar); (2) moderate (66-72% loss)--Liquidambar styraciflua (sweetgum), Acer (red maple), and Carya tomentosa (mockernut hickory); and (3) slow (38-53% loss)--Quercus alba (white oak), Q. ruba (northern red oak), Platanus occidentalis (American sycamore), and Fagus grandifolia (American beech). Insect taxa differing from the overall uniform distribution are: (1) Overabundance on slow leaves--Isonychia similus, Stenonema annexum, S. rubrum (Ephemeroptera); Cheumatopsyche sp., Hydropsyche sp. (Trichoptera); and Acroneuria abnormis (Plecoptera). (2) Overabundance on fast leaves--Simuliidae, Hydracarina. (3) Underabundance on slow leaves--Chironomidae. (4) Underabundance on fast leaves--Oligochaeta. Results also suggest that the direct role of macrodecomposers is relatively minor compared to the role of microbes. (Lynch-Wisconsin)
W79-09041

TRACE METAL TRANSPORT BY PARTICULATES AND ORGANIC CARBON IN TWO SOUTH CAROLINA STREAMS,
Savannah River Ecology Lab., Aiken, SC.
J. P. Giesy, Jr., and L. A. Briese.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1401-1417. 6 fig, 4 tab, 52 ref. ERDA EY-76-C-09-0819.

Descriptors: *Steel Creek(SC), *Upper Three Runs Creek(SC), *Trace elements, *Metals, *Path of pollutants, *Sediment transport, South Carolina, Organic carbon, Suspended solids, Streams, Heavy metals, Carbon, Hydrogen ion concentration, Soft water, Humics, Copper, Cadmium, Chromium, Zinc, Iron, Calcium, Magnesium, Manganese, Cobalt, Lead, Nickel.

A study was conducted of: (1) spatial and temporal variations of concentrations of 11 elements associated with six suspended and dissolved size fractions in two South Carolina coastal plain streams, and (2) relative importance of various fractions in trace metal transport. Study locations were Upper Three Runs Creek, an acid softwater stream, and Steel Creek, also softwater, but with higher pH, alkalinity and suspended solids, and less-colored water from organic carbon (OC). Elements monitored were calcium, cobalt, copper, cadmium, chromium, iron, magnesium, manganese, nickel, lead, and zinc. Conclusions: (1) the suspended solids load is much higher in Steel Creek, while in Upper Three Runs a higher proportion of suspended solids is organic; (2) most dissolved organic carbon in both streams have low molecular weight (<500); (3) lead is always more highly associated with larger organics, and in Steel Creek is transported mostly in suspended solids and in Upper Three Runs in the fraction with molecular weight 500; (6) most calcium is transported in the fraction with molecular weight 500, and is associated with all molecular weight organic fractions with similar Ca:OC ratios; (7) iron is transported in the suspended solids fraction in both streams, but up to 50% is transported in the 500 molecular weight fraction in Upper Three Runs in July; (8) Cu, Cd, Cr, and Zn are not highly associated with suspended solids, and are transported as free divalent ions or associated with organics; and (9) most Ni and Mn are in the smallest pore size ultrafilter fraction. (Lynch-Wisconsin)
W79-09042

BEHAVIOR AND BUDGETS OF SELECTED IONS IN THE WYE CATCHMENT,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
R. W. Edwards, A. C. Oborne, M. P. Brooker, and H. T. Sambrook.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1418-1422. 4 fig, 1 tab, 7 ref.

Descriptors: *Wye River Basin(Wales), *Nutrient budgets, *Calcium, *Silicon, *Nitrates, *Streamflow, Wales, River basins, Ions, Nutrients, Nitrogen, Silica, Diatoms, Algae, Chrysophyta, Water chemistry, Geology, Mollusks, Crustaceans, Invertebrates, Seasonal, Chlorophyll, Sphaerium corneum, Gammarus pulex, Asellus aquaticus, Rivers.

Water samples were taken from the River Wye's predominately rural catchment, Wales, at 15 sites 1975-76, and at one site from 1973 onwards, to study behavior and budgets of calcium, silicon (as reactive silica), and nitrate-nitrogen. Mean calcium increases from one mg/l in the upper basin to 32 mg/l downstream as a result of changing geology. Several invertebrates, including Sphaerium corneum, Gammarus pulex, and Asellus aquaticus, are restricted to sites with calcium levels above 10 mg/l. At all gauged sites except one calcium concentrations are related inversely to flow. Silica at one downstream site shows high winter concentrations (six mg SiO2/l) and low spring-summer ones (<0.5 mg/l). At the same site silicon and chlorophyll-a are correlated inversely with silicon depletion partly a result of diatom production. During April-July in the headwaters silicon concentration and flow are related inversely, whereas downstream the situation is reversed, probably reflecting diatom uptake of silicon in spring and summer during lower flows, which provide maximum retention time and opportunity for contact with benthos. At high flow maxima silica levels increase from three/mg/l upstream to seven mg/l downstream. Annual depletion within the river is about 3000 metric tons SiO2. Maximum nitrate values occur in winter (five mg/l) and minimum values in summer (0.13 mg/l) at a downstream site. May-December measured loads (10.6 kg/yr) are lower than calculated loads (12.7 kg/yr). Sewage accounts for 12% of calculated load. (Lynch-Wisconsin)
W79-09043

MEASUREMENT OF SULPHATE UPTAKE IN THE DARK BY SUSPENDED MICRO-ORGANISMS: APPLICATION TO RUNNING WATERS,
Quebec Univ., Montreal.
P. G. C. Campbell, and J. H. Baker.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1423-1428. 1 fig, 2 tab, 24 ref.

Descriptors: *River Frome(England), *Dark sulfate uptake, *Sulfates, *Analytical techniques, *Phytoplankton, *Diatoms, *Bacteria, Heterotrophy, Navicula pelliculosa, Melosira varians, Diatoma vulgare, Chrysophyta, Sulfur, Methodology, Eutrophication, Algae, Size, Fractionation, Seasonal, Darkness, Chlorophyll, Absorption, Seston, Glucose, Rivers, England.

Demonstration of dark sulfate uptake by the diatom Navicula pellicosa (70-72 ng S/l/hr, or 70% of the 104 ng uptake in the light) shows that sestonic diatoms contribute significantly to dark uptake of sulfate by suspended microorganisms in the River, southern England. Should dark sulfate uptake by phytoplankton prove generally true, the dark sulfate method of measuring planktonic heterotrophy would be seriously compromised. The River Frome is a relatively unpolluted, nutrient-rich chalk stream. Heterotrophic activity of suspended bacteria in the river was studied by measurement of dark sulfate uptake coupled with glucose incorporation measurements, a method which assumes that dark sulfate uptake by suspended algae is negligible, the concentration of reduced organic sulfur in the water is low (< 40 mu-g s-org/l), and the ratio of DOC uptake to sulfate uptake for bacteria is reasonably constant. Water samples were collected January-June 1977. Dark sulfate uptake is very low (five ng S/l/hr) until the end of March, but increases to 60 ng by early May, coinciding with the annual spring maximum of benthic diatoms dominated by Melosira varians and Diatoma vulgare. Size fractionation tests show organisms in the eight mu-m fraction responsible for an anomalously high proportion of total sulfate uptake. Since axenic cultures of the dominant diatom species were not readily available, dark sulfate experiments were conducted with N. pelliculosa, also present in the river. (Lynch-Wisconsin)
W79-09044

CONCEPT OF SPECIES SUCCESSION IN RELATION TO RIVER VEGETATION AND MANAGEMENT,
Freshwater Biological Association, Wareham (England). River Lab.
F. H. Dawson, E. Castellano, and M. Ladle.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, Part 2, p 1429-1434. 2 fig, 2 tab, 12 ref.

Descriptors: *Bere Stream(England), *Water management(Applied), *Stability, *Biological communities, *Rorippa nasturtium-aquaticum, *Ranunculus penicillatus var calcareous, *Succession, Macrophytes, Seasonal, Streams, Rivers, Piddle River basin(England), Dominant organisms, Biomass, Climate, Discharge(Water), Streamflow, Ecosystems, Ecology, Climax, Cycloclimax, Benthic flora, Chalk streams, Life cycles, Flood control, Maturity, Competition.

Annual succession of the codominant macrophyte species Ranunculus penicillatus var. calcareous and Rorippa nasturtium-aquaticum in Bere Stream, a chalk stream in the River Piddle basin, Dorset, England, represents a stable aquatic community which has reached Whittaker's 'cycloclimax'. The submerged Ranunculus typically regrows from rhizomes buried in the streambed during high fall discharge, increasing to maximum biomass and cover by late spring, when, with decreasing water velocity, Rorippa propagules invade, restricting Ranunculus growth except in areas of higher velocity. Fall floods wash out all emergent Rorippa, leaving only the few firmly rooted Ranunculus. Variations in timing of the cycle strongly affect biomass of the plants. The linkage of the two species is a type of homeostatic control ensuring persistence and long-term residence of both species. Biomass and production variations, particularly of Rorippa, are oscillations around a maximum persistent summer biomass, a feature typical of mature communities and ecosystems. In cycloclimax, generations are timed to annual environmental fluctuations. In Bere Stream the normal management regime minimizes flood risk through reduction of plant growth by severe cutting and restricting the Rorippa invasion. Designation of cycloclimax implies that environmental factors can be altered without greatly changing vegetation, though management may change life cycles. Artificial changes in the seasonal discharge pattern would affect the relative temporal dominance of the species. (Lynch-Wisconsin)
W79-09045

OBSERVATIONS ON A SPRING DIATOM BLOOM IN THE RIVER THAMES,
Water Research Association, Marlow (England).
T. J. Lack, R. E. Youngman, and R. W. Collingwood.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 2, p 1435-1439, 3 fig, 8 ref.

Descriptors: *Diatoms, *Discharge(Water), *Thames River(England), *Velocity, *Stephanodiscus hantzschii, *Limiting factors, *Eutrophication, Silica, Nitrogen, Phoshorus, Nutrients, Rivers, Chrysophyta, Algae, Phytoplankton, Water temperature, Solar radiation, Light intensity, Chlorophyll, Abundance, Conductivity, Nitrates, Phosphates.

Among several parameters, discharge or water velocity is the most important factor influencing diatom populations during spring phytoplankton bloom along 21 km of the Thames River, England.

between Reading and Hurley Lock. Silica never declined to limiting concentrations during this study in spring 1969, and nitrogen and phosphorus were at high levels (six mg NO3-N/l and 0.44 mg PO4-P/l). Though no consistent differences in conductivity can be detected among the sites, it is generally inversely related with chlorophyll concentration. Solar radiation fluctuates considerably from 29-436 cal/sq cm/day, but no clear relationship can be established with cell number. At all sites water temperature ranges 7.2-15.4 C, with no consistent differences among sites; however average temperature increases from 10.84 C upstream to 12.11 C downstream. Algal populations are composed largely of centric diatoms dominated numerically by Stephanodiscus hantzschii. All sites show close similarity between cell number and chlorophyll concentration, though cells vary in chlorophyll content 110,000-340,000 cells/mu-g. Discharge of the river sweeps away algal cells; critical discharge at Caversham in a previous study was 40 cu m/sec, at which velocity algae are swept away faster than they could divide. At all sites sudden increases in discharge are accompanied by rapid decreases in algal numbers and chlorophyll levels. (Lynch-Wisconsin)
W79-09046

DRIFT OF GAMMARUS PULEX L. IN RELATION TO MACROPHYTE CUTTING IN FOUR SMALL DANISH LOWLAND-STREAMS,
Miljostyrelsen, Silkeborg (Denmark). Freshwater Lab.
U. Kern-Hansen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1440-1445. 2 fig, 2 tab, 11 ref.

Descriptors: *Gammarus pulex, *Streams, *Aquatic weed control, *Mechanical control, *Amphipoda, *Environmental effects, Habitats, Macrophytes, Denmark, Invertebrates, Currents(Water), Limiting factors, Gransleeve Stream(Denmark), Lyngbyfard Stream(Denmark), Gjern Stream(Denmark), Fjederholt Stream(Denmark), Streamflow, Marginal vegetation.

Total cutting of macrophytes in four Danish lowland streams resulted in a great increase in drift density of the amphipod Gammarus pulex due to removal of the invertebrate's shelter from the current. Macrophytes provide shelter for a variety of invertebrates and fish. Partial cutting, leaving 50% of the macrophyte biomass in bars across the stream, did not significantly increase drift density, while leaving 35% of the biomass as narrow bars along stream margins resulted in a small increase in drift density. Sites with dense strands of macrophytes are also known to act as natural sieves, reducing the total distance travelled by drifting G. pulex. Upstream movements of G. pulex occurring especially in areas of slower current are normally sufficient to compensate for drift, but complete macrophyte removal reduces such areas of slower current and thus the possibilities for compensation. Leaving a narrow margin of plants helps to alleviate this situation. It is recommended that in programs of mechanical plant control a portion of the plants be left as transverse bars and another portion as narrow marginal stands. Experiments were conducted during the summers of 1974-76 in Granslev, Gjern, Lyngbygard, and Fjederholt Stream, the first dominated by Elodea canadensis, and Potamogeton crispus, the second and third by Spearganium simplex, and the last by Ranunculus peltatus. Streams are 80-90% covered by the plants, were unshaded, and have biomass in the range 200-350 g/sq m dry wt. (Lynch-Wisconsin)
W79-09047

RIVER GUDENA INVESTIGATION, 1973-1975,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
P. B. Heise, N. Nyholm, and J. F. Simonsen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1446-1450. 5 fig, 1 tab, 3 ref.

Descriptors: *Gudena River Basin(Denmark), *Water pollution control, *Sewage disposal, *Agricultural runoff, *Industrial wastes, *Water pollution sources, Urban runoff, Sewage treatment, Biological treatment, Biochemical oxygen demand, Lake Tange(Denmark), Denmark, Rivers, River basins, Nutrient loading, Nutrients, Phosphorus, Transparency, Phytoplankton, Algae, Mathematical models, Model studies, Dissolved oxygen, Primary productivity, Streamflow, Recreation.

A water quality study 1973-75 of the Gudena River Basin, Denmark, showed worst pollution in a tributary, Hadsten Lillea, which receives untreated sewage from the town of Hadsten (pop. 30,000) at a flow rate of 300 l/sec. A mathematical model simulating oxygen fluctuations indicates need for a biological treatment plant capable of limiting effluent BOD5 to 20 mg/l, ensuring that oxygen concentrations would not drop below two mg/l for more than four hrs anywhere in the river. In the basin as a whole, oxygen concentrations are satisfactory. The 145-km Gudena River, the longest in Denmark, drains an area of 2700 sq km known as the Danish Lake District, used for intensive recreation. Annually about 8000 tons COD, 4100 tons nitrogen, and 300 tons phosphorus are discharged to receiving waters. Domestic and industrial sewage account for some 20% of total nitrogen and 75% of total phosphorus loadings, and trout farms about 4% of nitrogen and 8% of phosphorus. Data on daily agricultural runoff show high correlation between water flow and nitrogen flux, but not with phosphorus because of a relatively high concentration of phosphorus in farm-discharged sewage. Background phosphorus levels are generally high, about 0.06 mg P/l. About 30% of annual nitrogen and 35% of annual phosphorus loadings are retained in lakes and watercourses due to sedimentation. The LAVSOE model was employed to predict effects of nutrient input control on phytoplankton and transparency in Lake Tange. (Lynch-Wisconsin)
W79-09048

AQUATIC WEED MANAGEMENT IN NATURAL STREAMS: THE EFFECT OF SHADE BY THE MARGINAL VEGETATION,
Miljostyrelsen, Silkeborg (Denmark). Freshwater Lab.
F. H. Dawson, and U. Kern-Hansen.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978, part 2, p 1451-1456. 4 fig, 2 tab, 8 ref.

Descriptors: *Marginal vegetation, *Shading, *Streams, *Aquatic weed control, *Vegetation establishment, Denmark, England, Water management(Applied), Flood control, Drainage, Bere Stream(England), Esrom Stream(Denmark), Granslev Stream(Denmark), Gjern Stream(Denmark), Fjederholt Stream(Denmark), Macrophytes, Environmental control, Habitats, Ranunculus, Elodea canadensis, Sparganium simplex, Rorippa nasturtium-aquaticum, Limiting factors, Depth, Light intensity.

Establishment of stream bank vegetation for shading is a good ecological alternative to mechanical cutting of aquatic weeds for land drainage and flood control purposes, based on experiments at Danish and English stream sites. Bushes or trees on the south bank of a stream will reduce light available at the stream surface by about two-thirds, resulting in a reduction in aquatic plant biomass by 70-90%; on the north bank vegetation may reduce plant biomass by about 50%. If a tree line is established on the south bank, 20-m gaps should be left every 70 m to allow growth of plants in bars across the stream to provide invertebrate habitats, fish cover, and traps for leaf litter. Shading reduces extreme and rapid development of macrophytes, spreads out their production, increases species diversity, and extends organic matter availability over a greater number of months. Intensive management through cutting and dredging restricts habitat diversity and encourages excessively even distribution and composition of biota and sediments. Experimental sites include Fjederholt, Granslev, Esrom, and Gjern Streams in Denmark, and Bere Stream in Dorset, England, subject to removal of various macrophytes, especially Ranunculus spp., Elodea canadensis, Sparganium simplex, and Rorippa nasturtium-aquaticum. To supplement the studies of vegetative shading, five 18-m stream sections of Fjederholt Stream were shaded with mesh, cloth, and plastic; plant regrowth is almost directly proportional to the light reaching the water surface, though water depth is also important. (Lynch-Wisconsin)
W79-09049

RESPONSE OF PHYTOPLANKTON TO WATER QUALITY IN THE CHOWAN RIVER SYSTEM,
North Carolina State Univ. at Raleigh. Dept. of Botany.
A. M. Witherspoon, C. Balducci, O. C. Boody, and J. Overton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 007, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. Rpt. No. 129, April 1979. 204 p, 124 fig, 7 tab. OWRT B-091-NC(2), 14-34-0001-6104.

Descriptors: *Phytoplankton, *Algae, Algal growth, Algal blooms, Nitrogen, Organic phosphorus, Chowan River(NC).

Seasonal changes in phytoplankton species diversity and biomass, phosphorus uptake kinetics, in-situ and in-vitro algal growth potential and phytoplankton-bacteria interaction in the Chowan River system were investigated from March 1974-June 1977. The river is divided into two sections with respect to phytoplankton dominants: (1) the upper, faster-flowing narrow section from its beginning at the confluence of the Nottoway and Blackwater Rivers to the bend in the river some 16 km downstream; and (2) the lower, wider section with very low water flow that extends approximately 64 km from the deep bend in the river to its mouth near Edenton, NC. The upper river is characterized by seasonal changes in dominants, usually of the flagellated types. Diatoms are omnipresent with fewer blue-green, green, and yellow-green algal types appearing seasonally. The lower river is characterized by filamentous blue-green algae during spring and summer. The slower-moving water in this section promotes longer residence time for nutrients and algae; therefore, it is plagued with seasonal algae blooms. There are five species that may become dominant during the blooms: (1) Anabaena circinalis, (2) Anabaena aegualis, (3) Anabaena wisconsinense, (4) Anacystis (Microcystis) firma, and (5) Aphanizomenon flosaquae (gracile). The blooms are inversely correlated with nitrate and phosphate concentrations in the river. However, substantial levels of biomass are able to persist after PO4, NO3, and NH3 concentrations are below detectable levels. In its present status, Chowan River water quality, without point-source input, is sensitive to the hyrographical and hydrophysical condition of the river. Sound management practices, therefore, must concentrate on the controllable conditions that potentially could further decrease water quality. (Kiger-North Carolina)
W79-09056

IMPROVING WATER QUALITY BY CONTROL OF ALGAE: BIOCHEMICAL CHARACTERIZATION OF THE POLYSACCHARIDES OF BLUE-GREEN ALGAE AND THEIR ROLE IN BACTERIAL-ALGAL,
Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.
R. B. Wildman, W. C. Wildman, G. E. Rottinghaus, and V. P. Cholvin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 149, Price codes: A07 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University, Report No. ISWRR1-94. Completion Report, April 1979. 127 p, 14 fig, 18 tab, 141 ref. OWRT B-059-IA(1). 14-34-0001-7119.

Descriptors: *Eutrophication, *Cyanophyta, *Aquatic bacteria, Aquatic life, Anabaena, Aquatic algae, Algae, Water pollution sources, Water qual-

ity control, Carbohydrates, Carbon, Lakes, Effluents, Industrial crops.

The relationship between a model bloom species, Anabaena spiroides, and the bacteria naturally associated with the mucilaginous algal sheath were studied. The structural properties and biochemical composition of the algal extracellular polysaccharide were examined comprehensively. During algal blooms, the dissolved carbohydrate in lake water was isolated and hydrolyzed, and the monosaccharide composition was determined. Isolates of sheath bacteria were cultured, nutritional requirements were determined, and the bacteria's ability to utilize algal polysaccharides and/or component monosaccharides was established. Extracellular polysaccharides were shown to be a major contributor to the dissolved carbohydrate found in natural waters. The extracellular polysaccharide of Anabaena spiroides was shown to be a large and complex molecule with linked xylose-glucose and fucose-arabinose units; branching sugars are linked rhamnose-fucose and glucose residues. The model bloom is a likely candidate for industrial applications due to its properties of high viscosity and pseudo-plasticity, and stability to ranges of temperature, pH, and salt concentration. High levels of dissolved organic matter are a preferred carbon source for aquatic bacteria, therefore a necessary deterrent to massive algal blooms may be removal or reduction of biodegradable organic matter from effluents entering aquatic systems. (Schaefer-IPA)
W79-09060

SURFACE WATER QUALITY PARAMETERS FOR MONITORING OIL SHALE DEVELOPMENT,
Environmental Monitoring and Support Lab., Las Vegas, NV.
W. L. Kinney, A. N. Brecheisen, and V. W. Lambou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 984, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/4-79-018, March 1979. 153 p, 8 fig, 52 tab, 65 ref, 1 append.

Descriptors: *Oil shales, *Water quality, *Water pollution, *Environmental effects, *Environmental impact, *Colorado River Basin, Surface waters, Energy conversion, Pollution monitoring, Water resources, Waste water(Pollution), Salinity, Biological communities, Hydrography, Industrial water, Microorganisms.

The potential environmental impact of oil shale development and the parameters needed for assessing and monitoring the impact on surface water resources are reported. Data are given for the proposed development of an oil shale industry on the western slope of the Rocky Mountains and the impact of the water resources of the Colorado River Basin. Potential impact areas discussed include: salinity, toxic substances, nutrients, hydrographic modification, microorganisms, radioactivity, oil and grease, temperature, sediments, dissolved oxygen, pH, and carbon dioxide. A prioritized list of chemical, physical, and biological parameters for monitoring surface waters potentially impacted is presented. Monitoring parameters include those substances which in themselves are potential pollutants and are measurable directly, as well as those indicator parameters whose measurements provide an indirect measure of pollution or are required for the interpretation of other water quality data. One of the major potential impacts reported was an increase in salinity. It was concluded that the establishment of a commercial oil shale industry in the studied area would pose a threat to the water resources of the Colorado River Basin, both on a regional and local scale. (Seigler-IPA)
W79-09069

STREAM MODELS FOR CALCULATING POLLUTIONAL EFFECTS OF STORMWATER RUNOFF,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 7C.
W79-09076

RESPONSE OF A SALT MARSH TO OIL SPILL AND CLEANUP: BIOTIC AND EROSIONAL EFFECTS IN THE HACKENSACK MEADOWLANDS, NEW JERSEY,
URS Co., San Mateo, CA.
P. C. Dibner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 211, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-109, June 1978. Prepared for the U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory, Cincinnati, Ohio. 61 p, 16 fig, 7 tab, 22 ref, 1 append. 68-03-2160.

Descriptors: *Salt marshes, *Oil spills, *Bank erosion, Estuarine environment, Rivers, Grasses, Marsh plants, Marshes, Water pollution effects, Oil pollution, Water pollution, Cutting management, Tidal marshes.

The biological and erosional response of portions of the Hackensack Meadowlands estuarine marsh to a two million gallon spill of number 6 crude oil in May 1976, and to the subsequent cleanup operations were examined. Contaminated vegetation which continued to release oil to the waters was cut and removed; these included the gross Spartina alterniflora. Damage to Spartina was primarily due to the physical, not chemical (toxic) properties of the oil. Heavily oiled Spartina that were neither washed clean by tides not cut had the highest mortality. Cutting plants as a technique for reducing long-term damage to them must, to be successful, take into account a combination of factors including the biology of the contaminated species, the elapsed time between contamination and cutting, the season in which cutting is performed, and the characteristics of the oil. For Spartina, cutting soon after contamination was beneficial and apparently reduced long-term damage despite the fact that it entailed trampling the grasses. This foot traffic may have contributed to severe bank erosion by making the river bank more susceptible to erosion by boat wakes and natural wave and current action. (Schaefer-IPA)
W79-09077

5D. Waste Treatment Processes

INSTITUTIONAL BARRIERS TO WASTEWATER REUSE.
California Univ., Los Angeles. Office of Environmental Science and Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 027, Price codes: A15 in paper copy, A01 in microfiche. Office of Water Research and Technology, Report OWRT/RU-79/4, (1979). 327 p, 86 fig, 3 append. OWRT R-0064(7814)(1). 14-34-0001-7814.

Descriptors: *Water reuse, Cost analysis, Decision making, *Governmental interrelations, Impaired water quality, Legal aspects, Political constraints, *Institutional constraints, Public health, *Reclaimed water, Recycling, Waste water disposal.

This study addresses institutional barriers to enhanced reuse of wastewater as a supplement or replacement for added freshwater supply. The primary vehicle has been three case studies of reclamation activities in southern California. Facilities used as examples are the San Jose Creek, Pomona and Water Factory 21 reclamation plants. Four areas of critical institutional concern are analyzed: (1) issues related to the administrative and institutional framework within which operations must be managed, (2) the legal framework which applies to reuse, (3) the economics, financing and pricing of reclaimed wastewater, and (4) issues growing from the risk to public health of reuse of treated wastewater. Conclusions as to issues of major importance are presented and recommendations drawn which could enhance wastewater reuse potential. The most important issues relate to health risk and its proper assessment. Others relate to the efficient, integrated planning and management of all water supplies. Proper cost comparisons between alternatives, consideration of external costs, and financing also constitute an important issue area. Legal requirements and the level of government best suited to manage also are considered. General conclusions as to further research needs are presented.
W79-09050

5E. Ultimate Disposal Of Wastes

INSTITUTIONAL BARRIERS TO WASTEWATER REUSE.
California Univ., Los Angeles. Office of Environmental Science and Engineering.
For primary bibliographic entry see Field 5D.
W79-09050

ASSESSMENT OF LAND TREATMENT TECHNOLOGY FOR TEXTILE MILL INDUSTRY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
D. Pal, and M. R. Overcash.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 030, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. Rpt. No. 140, June 1979. 33 p, 7 fig, 16 tab. OWRT B-100-NC(8), 14-34-0001-7173.

Descriptors: *Land treatment, Industrial wastes, *Textile mill industry, Textile mills, Land application, Dyes, Textile waste treatment.

The textile mill industry consisting of six subcategories of manufacturing must continually review the options for meeting state and federal environmental regulations. Land treatment is becoming a method of choice for an increasing number of mills. This report examines land treatment on a first-cut basis. Average plant sizes for each six subcategories are used along with representative waste and soil characteristics. These results do not represent design criteria because of the highly critical need to test the waste and site to be used, before specifying or permitting of such systems. Instead the results of this report should be used to compare the land treatment alternative of conventional processes. Although not included specifically, land treatment can meet the highest levels of waste treatment (RCRA, BAT, etc) when correctly designed, thus comparison against other alternatives should include the advanced wastewater treatment requirements for meeting present and future regulations. In addition to the evaluation of land treatment as an option for the textile mill industry, a fundamental design procedure is presented for land treatment design. This procedure demonstrates the detailed levels of soil and waste analyses required to design any land application system. Successful long term performance and adherence to soil, food-chain, groundwater nondegradation constraints depend on utilizing an in-depth design procedure. Results of this study have demonstrated the difference attributable to soils, the waste parameters which are critical in design, the potential savings associated with in-plant source control. (Kiger-North Carolina)
W79-09055

5G. Water Quality Control

NUTRIENT KINETICS OF PHYTOPLANKTON IN THE PAMLICO RIVER, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 2L.
W79-09057

WATER QUALITY MANAGEMENT MODEL FOR THE LOWER CHOWAN RIVER,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W79-09058

PROTECTION, CLEANUP AND RESTORATION OF SALT MARSHES ENDANGERED BY OIL SPILLS: A PROCEDURAL MANUAL,

URS Co., San Mateo, CA.
D. J. Maiero, R. W. Castle, and O. L. Crain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 958, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-220, November 1978. Prepared for the U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory, Cincinnati, Ohio. 164 p, 26 fig, 14 tab, 5 append. 68-03-2160.

Descriptors: *Salt marshes, *Oil spills, *Water pollution control, Marshes, Tidal marshes, Oil pollution, Water pollution effects, Water pollution sources, Publications, Coastal marshes, Water pollution treatment, Oily water.

Information and guidelines on the best application of protection, cleanup, and recovery activities from oil spills in order to minimize the damage to marshlands and to speed their recovery are provided. A step-by-step approach to protective, cleanup, restoration, and waste handling measures is given. The user's basic knowledge of oil spill characteristics and attendant technologies as well as a basic understanding of the coastal environment is assumed. Classification schemes for oil and marsh are discussed. Protective measures are detailed including: field observations; spill size and movement prediction; general protection priorities; protective devices and techniques, their selection and impact; and termination of the measures. As with the protective phase, a gathering of general information, knowledge of the characteristics of the spilled oil, identification of the sensitivity and unique features of the endangered marshland, and an investigation of any threat against public and personnel safety is necessary in the cleanup phase. Natural cleaning, recontamination potential, cleanup techniques, their selection and impact access/trafficability, general priorities, and degree of cleanup are detailed. Natural recovery versus the need for restoration, restoration techniques, monitoring of restoration, and methods of waste handling are discussed. (Schaefer-IPA)
W79-09073

ACHIEVING IRRIGATION RETURN FLOW QUALITY CONTROL THROUGH IMPROVED LEGAL SYSTEMS,
Resources Administration and Development, Inc., Fort Collins, CO.
G. E. Radosevich, and G. V. Skogerboe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 653, Price codes: A14 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-184, December 1978. Prepared for the U.S. Environmental Protection Agency, Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma. 311 p, 55 fig, 4 tab, 64 ref, 3 append. R-804303.

Descriptors: *Return flow, *Water quality control, *Legal aspects, Water law, Water rights, Administrative agencies, Irrigation water, Water pollution sources, Water reuse, Water pollution control, Water quality standards, Regulation, Agricultural chemicals, Legislation.

An examination of the water quality control laws of the western states and of the extent to which the two legal systems (quantity and quality control) interface are presented. The integration of legal controls with physical/technical realities is explored. Irrigation return flows contribute to the problem of deteriorated water quality through use of water, land, and agricultural chemicals. Return flows occur from seepage losses, deep percolation, and tailwater runoff; pollutants include salinity, nitrates and phosphates (or nutrients), sediments, biocides, and bacteria. Three recommendations are made for Federal and State activities to achieve quality control for irrigation return flow: an action program, called the Influent Control Approach; a course of action to implement the program; and an identification of research needs. The program requests the states to: (1) designate areas and responsible entities for irrigation return flow quality management; (2) develop standards and criteria; (3) introduce incentives for efficient water use; (4) include water quality in water rights; (5) adopt and enforce a reporting and recording system for water rights; (6) recognize reasonable degradation from agricultural water use; (7) adopt an Agriculture Practice Act; and (8) promote cooperation of state water agencies. (Schaefer-IPA)
W79-09079

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

QUANTITATIVE SITUATIONAL ANALYSIS, A PLANNING TOOL FOR WATER RESOURCE MANAGERS.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
H. Johnston Nicholson, and C. H. Castore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 116, Price codes: A09 in paper copy, A01 in microfiche. Technical Report No. 120, March 1979. 191 p, 8 fig, 56 tab, 88 ref, 14 append. OWRT C-7005 (no. 6202)(9).

Descriptors: *Water resources planning, *Cost benefits, Risks, Nuclear power plants, Potable water, Herbicides, D 2-4 herbicide, T 2-4-5 herbicide, Defoliants, Decision making, Public participation, Power plant siting.

A planning methodology is developed which provides for the water resource managers and decision makers a procedure for structuring and quantifying public input into water resources management decisions. The method referred to as Quantitative Situational Analysis provides an opportunity to assess and predict the response of public officials, intensely interested groups, and the general public to a technology innovation which may be of a controversial nature. The procedure is especially adapted to those decisions involving low risk - high consequence technology. The report discusses the theoretical basis for the method and then develops three case studies involving low risk-high consequence technologies. One is the siting of a nuclear power plant, using the Bailly plant, to be located on Lake Michigan. Another is the implementation of the Safe Drinking Water Act and the public's perception of its importance and adequacy. The third is the local people's reaction to the U.S. Air Force's decisions to dispose of 2.3 million gallons of herbicide 'Orange' on some Federal land in Utah. Results of each of these case studies are presented. (Wiersma-Indiana)
W79-09051

AQUIFER MODELING BY NUMERICAL METHODS APPLIED TO AN ARIZONA GROUNDWATER BASIN,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
G. E. Fogg, E. S. Simpson, and S. P. Neuman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 962, Price codes: A08 in paper copy, A01 in microfiche. Technical Report 32, June 1979. 140 p, 34 fig, 9 tab, 46 ref. OWRT C-7515(no. 6235)(1), 14-34-0001-6235.

Descriptors: *Model studies, Arizona, Groundwater, Computer models, Groundwater recharge, *Aquifer modeling.

FLUMP, a recently developed mixed explicit-implicit finite-element program, was calibrated against a data base obtained from a portion of the Tucson Basin aquifer, Arizona, and represents its first application to a real-world problem. Boundary conditions used in the calibration of FLUMP were prescribed hydraulic heads obtained from direct measurement. At prescribed head boundaries FLUMP computed time-varying fluxes representing subsurface lateral flow and recharge along streams. FLUMP correctly calculated fluctuations in recharge along the Santa Cruz River due to fluctuations in storm runoff and sewage effluent rates and provided additional distributions of recharge, discharge, and subsurface flow in the study area. Properties of FLUMP were compared with those of ISOQUAD, a finite-element program developed by Pinder and Frind, and a finite-difference program developed by the U.S. Geological Survey. It appears that FLUMP can handle a larger class of problems than the other two programs, including those in which the boundary conditions and aquifer parameters vary arbitrarily with time and/or head. FLUMP also has the ability to solve explicitly when accuracy requires small time steps, the ability to solve explicitly in certain parts of the flow region while solving implicitly in other parts, flexibility in mesh design and numbering of nodes, computation of internal as well as external fluxes, and global as well as local mass balance checks at each time step.
W79-09052

A MATHEMATICAL HYDRODYNAMIC CIRCULATION MODEL OF GREAT SALT LAKE FOR RESOURCE MANAGEMENT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 2H.
W79-09054

WATER QUALITY MANAGEMENT MODEL FOR THE LOWER CHOWAN RIVER,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
M. Amein, and W. S. Galler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 188, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute of The University of North Carolina, Raleigh. UNC-WRRI Rpt. No. 130, April 1979. 159 p, 42 fig, 8 tab. OWRT B-081-NC(2), 14-34-0001-5099.

Descriptors: *Mathematical models, Stream forecasting, Algal biomass, Nitrogen uptake, *Chowan River(NC).

A mathematical numerical model for the Lower Chowan River was developed to predict water quality under the influence of changing flow, temperature, tide, and wind conditions, and inputs of wastes and nutrients and to predict the effectiveness of control measures for water quality management. This model was developed for the Chowan, but is actually a general river and estuary model which can be applied to any waterway which can be treated as a one-dimensional flow channel. The application is entirely controlled by means of input data. The model consists of two parts: (a) a flow dynamics module, and (b) a water quality module. The flow dynamics module is based on the finite difference representation of the equations for the conversion of mass and momentum of water flow in estuaries. The water quality module is based on the finite difference representation of the diffusion equation. There is great variability in the field data, and the model was calibrated to predict the average conditions. Detailed analyses of the estuarine processes are needed to determine critical values for nutrient concentrations and optimum conditions of light, temperature, and water flow for blooms. (Kiger-North Carolina)
W79-09058

6B. Evaluation Process

ENERGY FROM THE WEST: ENERGY RESOURCE DEVELOPMENT SYSTEMS REPORT, VOLUME VI: GEOTHERMAL,
Oklahoma Univ., Norman. Science and Public Policy Program.
I. L. White, M. A. Chartock, R. L. Leonard, S. C. Ballard, and M. Gilliland.
Report No. EPA-600-7-79-060f, March 1979. Prepared for U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C. 217 p, 12 fig, 61 tab, 18 ref. 68-01-1916.

Descriptors: *Geothermal studies, *Energy conversion, *Environmental effects, *Hydrothermal studies, Exploration, Drilling, Thermal power, Steam, Water vapor, Cost analysis, Water pollution, Air pollution, Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, Wyoming.

The technologies, inputs, outputs, rules, and regulations associated with the development of geothermal energy resources in eight western states are described. A general description of the geothermal energy resources is provided along with the steps or activities involved in developing each. Geology, location, quantity, physical and chemical characteristics, and property ownership are among areas covered. Activities involved in the development of geothermal energy resources include: exploration, extraction (both drilling and production phases), and electricity generation or non-electric utilizations. For each activity, technological alternatives are discussed which represent potential development options. Input requirements and output for each activity or alternative are presented where possible. Input requirements include: manpower, materials and equipment, economics, water, land, and ancillary energy. Outputs, the residuals from each activity or alternative that may pose environment hazards, include: air emissions, water effluents, solid wastes, noise pollution, occupational health and safety hazards, and odor. Laws and regulations governing the development of geothermal resources are also discussed. (Seigler-IPA)
W79-09066

6E. Water Law and Institutions

TODAY IS YESTERDAY'S TOMORROW,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 6G.
W79-08832

6G. Ecologic Impact Of Water Development

TODAY IS YESTERDAY'S TOMORROW,
Canada Centre for Inland Waters, Burlington (Ontario).
J. R. Vallentyne.
In: Proceedings: 20th Congress, Internationale Vereinigung fur Theoretische und Angewandte Limnologie; Copenhagen, Denmark, 8 August 1977. Vol. 20, September 1978. Part 1, p 1-12, 9 tab, 10 ref.

Descriptors: *Energy conservation, *Demophoric index, *Resource management, *International cooperation, *Environmental carrying capacity, *Theoretical analysis, Conservation, Energy, Metabolism, Technology, Water pollution control, Limnology, Runoff, Ecology, Ecosystems, Demography, Population.

The concepts of environmental carrying capacity and demographic (D) index are discussed, the current status of energy consumption among world nations is assessed, and a resolution relating to global resource consumption (especially as it pertains to water resources) is proposed for approval at the 20th Congress of the Internationale Vereinigung fur Theoretische und Angewandte Limnologie in Copenhagen, Denmark (8 August 1977). 'Demophoric' refers to the unusual status of man's mass and metabolism, which combines both internal (biological) and external (technological) components, not explicitly recognized in ecological terms until the 1970s. Tables are presented which relate population (P), technological population or energy slaves (T), demophoric units (P+T), and demophoric index (T/P), the ratio of technological to biological metabolism, for various countries of the world. One D-unit=829,000 kcal/yr. Average global D-index is 16, ranging from < 1 in several African countries to 97 in the United States, which also has the highest number of D-units (20.4 billion). Since the earth's demophoric carrying capacity is rapidly being approached, or has already been exceeded, it is imperative that worldwide control measures be taken. A 70-year lead time is proposed for achieving an orderly political progression to an eventual state of zero demophoric growth. (Lynch-Wisconsin)
W79-08832

EUTROPHICATION MODEL FOR THE MIDDLE REACHES OF THE LOIRE (MODELE D'EUTROPHISATION DE LA LOIRE MOYENNE),
Echauffement et Pollution des Eaux, Ecologie Div., Chatou (France).
For primary bibliographic entry see Field 5C.
W79-08990

7. RESOURCES DATA

7A. Network Design

AN IMPROVED OXYGEN METHOD FOR MEASURING PRIMARY PRODUCTION IN LAKES,
Bern Univ. (Switzerland). Zoologisches Inst.
For primary bibliographic entry see Field 5C.
W79-08835

7B. Data Acquisition

REMOTE SENSING,
General Electric Image Processing Lab., Beltsville, MD.
C. Croteau.
Water Spectrum, Vol. 11, No. 3, p 46-53, Summer 1979. 6 fig, 1 tab.

Descriptors: *Remote sensing, *Water resources development, Exploration, Mapping, Landsat, Satellites(Artificial), Planning, Photography, Photogrammetry, Analytical techniques.

The present state of remote sensing is examined, and future use is projected. Remotely sensed parameters have been used as input for studies related to water resources systems planning, design, and management. Remote sensing is a vital part of ice and snow mapping. Liquid and solid forms of water can be detected and measured by remote sensing; the trained observer reads indirect signs, as well as those directly observable, that indicate water. It is difficult to remotely assess water quality, but there is significant value in the ability to observe turbidity. Remote sensing systems generally consist of four components: the platform (usually an airplane or satellite), the sensor, communications equipment to transmit the sensor signal, and processing equipment, which converts the transmission to understandable data. A trend toward computerized, non-photographic sensing systems is accelerating due to the availability of digitized data, the rapidly declining costs of computer hardware, and the performance advantages of the medium. Systems designed to detect change require registration, or overlay of data taken at different times and a data base keyed to geography. Improved resolution, timeliness, data compatability, and more frequent coverage are expected in future systems. (Schaefer-IPA)
W79-09063

RATES, CONSTANTS, AND KINETICS FORMULATIONS IN SURFACE WATER QUALITY MODELING,
Tetra Tech, Inc., Lafayette, CA.
S. W. Zison, W. B. Mills, D. Deimer, and C. W. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 938, Price codes: A15 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-105, December 1978. Prepared for the U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, Georgia. 335 p, 30 fig, 72 tab, 358 ref. R804450-01-2.

Descriptors: *Surface waters, *Water quality, *Model studies, Analytical techniques, Mathematical models, Structural models, Reaeration, Dissolved oxygen, Nitrification, Oxygen demand, Phytoplankton, Algae, Zooplankton, Coliforms, Measurement, Hydrodynamics, Chemistry, Biology.

A set of formulations and associated constants in the field of water quality modeling is presented as comprehensively as possible. A process-oriented literature review of rate parameters used in surface water quality models includes information of model conceptualization, and physical, biological, and chemical processes. Geometric representations, temporal variations, and hydrodynamic considerations are discussed in relation to model conceptualization. Advective and dispersive transport, heat budgets, ice formation, and light attenuation were the physical processes reviewed. Biological processes reviewed included dish, detritus, benthic organisms, and sediment deposits; chemical processes reviewed included the nitrogen, phosphorus, and silicate cycles, dissolved oxygen, toxic materials, the carbonate system, and conservative substances. A very detailed discussion of selected parameters and formulations is presented on issues that are ordinarily of primary interest in modeling studies: reaeration, dissolved oxygen saturation, photosynthesis (without modeling phytoplankton), biochemical and benthic oxygen demands, nitrification, coliform bacteria, phytoplankton, and zooplankton. (Schaefer-IPA)
W79-09078

7C. Evaluation, Processing and Publication

STREAM MODELS FOR CALCULATING POLLUTIONAL EFFECTS OF STORMWATER RUNOFF,
Municipal Environmental Research Lab., Cincinnati, OH.
R. Smith, and R. G. Eilers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 930, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-148, August 1978. 107 p, 18 fig, 16 tab, 20 ref, 3 append.

Descriptors: *Storm runoff, *Water pollution effects, *Mathematical models, Overflow, Dissolved oxygen, Storm water, Streams, Data processing, Computer programs, Water pollution, Hydraulic models, Equations, Rivers, Biochemical oxygen demand.

Three related studies for developing better methods for quantifying the pollutional effects in streams caused by stormwater overflows are described. Mathematical models developed simulate the biological, physical, chemical, and hydraulic reactions that occur in a flowing stream. The relationships are presented as differential or difference equations with the two independent variables: time and distance along the stream. Analog or digital computers, or calculus can be used to find solutions to the differential equations. This solution is the concentration of all species of pollutional interest within the stream as a function of time and distance. There are two regimes of solutions--steady-state and transient; the pollution loads on a stream can also be specified as steady-state or transient. Two digital computer programs were developed: one computes the dissolved oxygen (DO) deficit in a stream as a function of time and distance along the stream caused by any specified overflow; the second computes the hydraulic effect on the stream of large volume overflows. A method for summarizing the results of computations in an easily used manner was also developed. Because of advanced technology, it is now possible to estimate the impact of any stormwater overflow on the dissolved oxygen resources of a stream by hand computation. (Schaefer-IPA)
W79-09076

8. ENGINEERING WORKS

8A. Structures

HELSINKI METROPOLITAN AREA WATER SUPPLY AND WATER QUALITY IN LAKE PAIJANNE,
Hydrobiological Research Inst., Jyvaskyla (Finland).
For primary bibliographic entry see Field 5C.
W79-08964

LOOK BACK AT THE FUTURE,

Field 8—ENGINEERING WORKS

Group 8A—Structures

N. Clapp, and A. H. Garner.
Water Spectrum, Vol. 11, No. 3, p 20-26, Summer 1979. 8 fig.

Descriptors: *Hydroelectric plants, *Dams, *Rehabilitation, Electric powerplants, Hydroelectric power, Electric power production, Water utilization, Dam construction, Comparative costs, Electric power rates, Power marketing.

The history of hydroelectric power and the undeveloped potential of existing dams are examined. Today's major marketers of hydroelectric power are the Tennessee Valley Authority (TVA), the Department of Energy, and the Power Authority of the State of New York. Over 220 billion kilowatt hours were generated and almost 69 million kilowatts of power were provided in 1977. Big dams provided a lower per-unit cost than smaller sites and smaller stations were allowed to fall into a state of disrepair. The increase in the cost of constructing large-scale generating capacities, and the enormous increase in the cost of fuel oil for intermediate or peak-load generation have prompted a new look at old dams. A great number of small, unused dams exist throughout the country, and there is a comparative absence of environmental problems in making use of already existing dams and reservoirs. Plans have been made for the small plant at Paterson, New Jersey, which closed in 1971, to be restored. During 1981, the first year of operation, value is projected at 2.98 cents per kilowatt-hours; comparing this to production costs, revenues will exceed costs. Costs for rehabilitating small dams are expected to run $1,000 to $2,000 per kilowatt of capacity. As much as $54,600 megawatts of undeveloped capacity exists at such structures. (Schaefer-IPA)
W79-09061

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 20
OCTOBER 15, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 20
OCTOBER 15, 1979

W79-09081 -- W79-09330

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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ACCESSION NUMBER INDEX

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS,
Texas A and M Univ., College Station. Remote Sensing Center.
For primary bibliographic entry see Field 7B.
W79-09134

NON-POINT SOURCE STUDIES ON CHESAPEAKE BAY, 4: WEEKLY SURFACE HYDROLOGY OF SEVEN SUB-BASINS WITHIN THE RHODE RIVER WATERSHED, CALENDAR YEARS 1974-1975-1976, CRC PUBLICATION NO. 57,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
G. R. Chirlin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 863, Price codes: A04 in paper copy, A01 in microfiche. CRC Publication No. 57, NSF/RA-770383, May 1977. 62 p, 14 fig, 5 ref, 4 tab, 1 append. NSF R804536-01.

Descriptors: *Maryland, *Chesapeake Bay, *Watersheds(Basins), Hydrology, Rivers, Water quality, Stations, Sampling, Flow, Networks, Precipitation(Atmospheric), Runoff, Land use, Surface waters, *Sub-basins, *Rhode River(MD), Non-point sources.

In Part IV of this project, weekly total precipitation, runoff, and their difference net input were tabulated for 7 tributary sub-basins of Rhode River, Maryland, watershed. The data were discussed briefly. The limitations of a three raingage network to sample 982 ha over 7 sub-basins were examined, and coefficients of variation up to 0.57 were found for weekly precipitation totals above 2.5 cm. (Froehlich-ISWS)
W79-09136

GEOHYDROLOGY OF COMAL, SAN MARCOS, AND HUECO SPRINGS.
Texas Department of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-09139

EFFICIENCY OF THE REAL-TIME HYDROLOGICAL FORECASTING SYSTEMS IN POLAND AFTER SYSTEM OPERATION IN 1975-77,
Institute of Meteorology and Water Management, Warsaw (Poland).
E. Bobinski, T. Piwecki, and J. Zelazinski.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria) 28p, 5 fig, 2 tab, 10 ref.

Descriptors: *Hydrologic systems, *Forecasting, *Poland, *Rivers, Efficiencies, Hydrographs, Mathematical models, Performance, Real-time, Water management(Applied), Meteorology, River systems, Systems analysis, Data transmission, Data collection, Rainfall, Runoff, Channel routing.

The development and implementation of a real-time hydrologic forecasting system for water management is now the key task for Poland's Hydrometeorological Service. These systems are to be implemented for the operation of some dozen major reservoirs and for the management of navigable reaches of two large Polish rivers: the Vistula and the Odra. Operated in the summer are two mountainous rivers: Considered are the Sola and the Dunajeo/rainfall-runoff model, and the river stage/depth hydrograph forecast system for the lower Vistula/channel routing model. Discussed are system implementation, operation and efficiency. Emphasis herein is on the experience gained with the system implementation and operation, especially in terms or organization of the data collection, transmission and processing, hardware and staff employed, the forecast efficiency, and several new problems arising. (See also W79-09285) (Bell-Graf--Cornell)
W79-09289

OPERATIONAL HYDROLOGICAL FORECASTING BY CONCEPTUAL MODELS IN SWEDEN,
Swedish Meteorological and Hydrological Inst., Norrkoping.
S. Bergstrom.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 19 p, 8 fig, 1 tab, 3 ref.

Descriptors: *Sweden, *Runoff, *Forecasting, *Model studies, Watersheds(Basins), Hydrologic data, Data collection, Data processing, Flooding, Risks, Spring, Costs, Benefits, Snowmelt, Precipitation, Simulation analysis, Rivers, Systems analysis.

Since 1972, the Swedish Meteorological and Hydrological Institute (SMHI) has been engaged in the development of a conceptual runoff model suitable for operational forecasting and other applications under Scandinavian conditions. The model now operates in ten catchments in Sweden, and forecasts are issued regularly every spring and on some occasions in autumn and winter. Discussed herein are: model structure and calibration; applications for operational forecasting; data collection and processing; updating the model; forecasting procedures; short-range forecasting; forecasts at remaining springflood volumes; estimation of risks for high floods; and costs and benefits. (See also W79-09285) (Bell-Graf--Cornell)
W79-09290

DIFFUSION EQUATION AS A IMPULSIVE RESPONSE FOR THE FLOOD EVENTS MODELLING,
Hydrometeorologicky Ustav, Prague (Czechoslovakia).
J. Buchtele.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 25 p, 5 fig, 1 tab, 10 equ, 12 ref, 2 append.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, *Simulation analysis, *Model studies, *Diffusion equation, Flood volume, Flood events, Water storage, Equations, Transformation procedure, Systems analysis.

The procedure herein, expressing the variability of impulsive response in dependence on three characteristics of rainfall, was examined as a compromise between the models with distributed parameters and simplifying lumped models. Used characteristics are: rainfall intensity, distance of rainfall center from the watergage station and the index of areal nonuniformity. These characteristics were taken as the parameters for the diffusion equation, which is used for analytical expression of impulsive response. The experiments were made with the set of 30 floods (25 of which were from the same catchment). The procedures for estimation of the flood volume and discharges in rainless periods are also briefly described. (See also W79-09285) (Bell-Graf--Cornell)
W79-09291

THE USE OF HYDROLOGICAL MODELS FOR RUNOFF FORECASTS FOR SHORT-TIME OPTIMIZATION OF THE NORWEGIAN WATER POWER SYSTEM,
B. Wingard.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 19 p, 7 fig, 1 tab, 11 ref.

Descriptors: *Hydropower, *Runoff, *Forecasting, *Hydrologic models, *Optimization, *Simulation analysis, *Norway, ARIMA model, Weather forecasts, Production plans, Model testing, Watersheds(Basins), Spring, Systems analysis.

A project was organized in 1977 to compare 4 hydrological models for runoff forecasting for short-time water power optimization. Two conceptual models were found to give reliable results for forecasting of total spring volume. An ARIMA model was recommended for computations of spring runoff and volume due to its difficult-to-model varying climatic conditions. Actual research fields to improve models and data were better snow and soil routines, and more relevant observations of snow reservoir, soil reservoir, precipitation and temperature. Input to the forecasting models are meteorological quantitative forecasts, a field that should be given much attention. Suggestions of how to implement hydrological forecasts in the daily work of the hydropower companies are presented. The costs of model calibration, updating and forecasting are shown together with the data needs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09292

USE OF CATCHMENT MODELS FOR FLOOD FORECASTING IN CENTRAL AMERICA,
World Meteorological Organization, Geneva (Switzerland).
A. J. Askew.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 8 p, 4 ref.

Descriptors: *Flood forecasting, *Mathematical models, *Central America, *Watersheds(Basins), Projects, Data collections, Personnel, Computers, Developing countries, Systems analysis, Simulation analysis, Hydrology.

Between 1976 and 1978, a WMO/UNEP project was undertaken, one of the aims of which was to test the feasibility of using mathematical catchment models in flood forecasting systems in Central America. The Sacramento and CLS models were installed in the region and fitted to local catchments. The experience gained during the execution of the project has permitted a number of useful conclusions to be drawn concerning problems that may be encountered in applying catchment models in developing countries. Both the CLS and Sacramento models are now securely installed at centers in the region and are available for use by local hydrological services. (See also W79-09285) (Bell-Graf--Cornell)
W79-09294

HYSIM - A PHYSICALLY REALISTIC, GENERAL PURPOSE, HYDROLOGIC MODEL,
Severn-Trent Water Authority, Birmingham (England).
R. E. Manley.
In: Internationale Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Australia). 21 p, 1 fig, 1 tab, 8 ref.

Descriptors: *Hydrology, *Mathematical models, *Simulation analysis, Computer programs, Watersheds(Basins), Flow, Hydrologic data, Hydraulics, Costs, Severn River(England), Systems analysis.

During the past 20 years, many hydrological simulation models have been developed, but only a

small proportion have been widely used, being employed for relatively limited research exercises. This paper describes HYSIM (Hydrologic Simulation Model). It has been used for three years in the Severn-Trent Water Authority, the second largest in England and supplier of the full range of water services to 8 million consumers. It has also recently been made available to additional organizations including other water authorities, research institutions, and consultants. The paper begins by briefly describing the model itself and then its development. The major part of the article examines the application of the model and the role it has played in the functioning of the water authority. (See also W79-09285) (Bell-Graf--Cornell)
W79-09296

LINEAR MATHEMATIC MODEL SIMULATING SURFACE OUTFALL IN A MOUNTAIN CATCHMENT AREA,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Ostrowski.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 22 p, 3 fig, 20 equ, 12 ref.

Descriptors: *Rainfall-runoff relationships, *Simulation analysis, *Watersheds(Basins), *Surface runoff, Measurement data, Data requirements, Optimization, Linear model, Equations, Computers, Systems analysis.

Presented is a linear mathematical model of the surface runoff due to rainfalls. The model refers to basic hydrological processes influencing the surface runoff. The model's structure is presented along with the measurement data requirements and with optimization, identification, and verification techniques. The attached graphs illustrate a high degree of correlation between results of model simulation and field measurements. Finally, practical aspects of the model's application are discussed in relation to the computing technique. (See also W79-09285) (Bell-Graf--Cornell)
W79-09297

AUTOMATIC CALIBRATION OF THE TANK MODEL,
M. Sugawara.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 22 p, 11 fig.

Descriptors: *Tank model, *Simulation analysis, *Hydrology, *Computers, *Calibration technique, Effects, Discharge(Water), Equations, Hydrographs, Rivers, Computer programs, Feedback, Rainstorms, Systems analysis.

In spite of its simplicity, the tank model presented herein can yield good results to rivers of many regions; owing to its simple structure, there is no difficult problem in terms of computer technique, and its program is easy to understand for users. The only difficult problem is the calibration of the model, partly because of its nonlinear structure and partly because its structure is very difficult for input-output analysis. Accordingly, the only way is the method of trials and errors. To make the automatic calibration program is the most important point of the computer technique for the tank model. Considered herein are: (1) the necessity of the automatic calibration program; (2) the division into subperiods; (3) model use; (4) feedback formulae; (4) effect of random deviation of the time lag of peak discharge; (5) some improvement for the quick convergence; (6) modified mean square error; (7) divergence; and (8) the necessity for the feedback system which is strong against noises. (See also W79-09285) (Bell-Graf--Cornell)
W79-09299

2B. Precipitation

STOCHASTIC MODELS FOR DERIVING INSTANTANEOUS PRECIPITATION RATE DISTRIBUTIONS,
Air Weather Service, Scott AFB, IL.
A. R. Davis, and D. J. McMorrow.
Report AWS-TR-263, July 1976. 25 p, 42 tab, 16 ref.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Model studies, Mathematical models, Stochastic processes, Computer models, Data processing, Analytical techniques, Climatic data, Climatology, Meteorology, *Instantaneous precipitation rates, Precipitation rates, Rainfall rates.

One-minute and 4-minute precipitation rate records were used to develop stochastic model relations between clock-hour and 1-minute (or 4-minute) precipitation rate distributions. These models can be used to estimate annual and seasonal distributions of instantaneous precipitation rates for locations where distributions of clock-hour rates are known. The models were derived for 13 locations. (Sims-ISWS)
W79-09151

2C. Snow, Ice, and Frost

GLACIOLOGICAL DATA, THIS ISSUE: GLACIOLOGICAL FIELD STATIONS, PART I,
World Data Center A for Glaciology, Boulder, CO.
R. Vivian.
Report GD-4, February 1979. 110 p, 1 tab, 143 ref.

Descriptors: *Glaciology, *Data collections, *Geophysics, Foreign countries, Glaciers, Snow, Ice, Publications, Stations, Foreign research, Research and development, Glaciological field stations.

In October 1977, a questionnaire was circulated to all glaciologists belonging to the International Glaciological Society and to various national and international organizations concerned with snow and ice. The objective of the questionnaire was to assess the worldwide mechanisms used for glaciological research, with particular reference to glaciological field stations. The following information was collected: the location of centers of glaciological studies, regional distribution of centers, center activities and staff and materials available at each center, what particular problems are studied at each center, when the studies began, how the data are collected, in what form the data exist, and what publications describe and tabulate the research. The report was published in 2 parts. (See also W79-09133) (Froehlich-ISWS)
W79-09132

GLACIOLOGICAL DATA, THIS ISSUE: GLACIOLOGICAL FIELD STATIONS, PART 2,
World Data Center A for Glaciology, Boulder, CO.
R. Vivian.
Report GD-4, February 1979. 130 p, 1 map, 130 ref.

Descriptors: *Glaciology, *Data collections, *Geophysics, Foreign countries, Glaciers, Snow, Ice, Publications, Stations, Foreign research, Research and development, Glaciological field stations.

In October 1977, a questionnaire was circulated to all glaciologists belonging to the International Glaciological Society and to various national and international organizations concerned with snow and ice. The objective of the questionnaire was to assess the worldwide mechanisms used for glaciological research, with particular reference to glaciological field stations. The following information was collected: the location of centers of glaciological studies, regional distribution of centers, center activities and staff and materials available at each center, what particular problems are studied at each center, when the studies began, how the data are collected, in what form the data exist, and what publications describe and tabulate the research. The report was published in 2 parts. (See also W79-09132) (Froehlich-ISWS)
W79-09133

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 1.
Colorado Univ., Nederland. Inst. of Arctic and Alpine Research.
December 1978. 47 p.

Descriptors: *Glaciology, *Snow, *Ice, *Bibliographies, Computers, Snow cover, Glaciers, Avalanches, Polar regions, Sea ice, Permafrost, Abstracts, Data collections, Publications, Paleoglaciology, Polar ice.

The first quarterly list of documents acquired by the Data Center during the period June-August 1978 has been published. The list was generated from a new computerized bibliographic data system. Books, technical reports, conference proceedings and reprints were included; most journal articles have not yet been indexed. The subject headings are those used by the Cold Regions Research and Engineering Laboratory in their Bibliography on Cold Regions Sciences and Technology. Bibliographic items were repeated in their entirety under each appropriate subject heading. (Froehlich-ISWS)
W79-09135

SOME PHYSICAL PROPERTIES OF SEA ICE. I,
McGill Univ , Montreal (Quebec). Ice Research Project.
E. R. Pounder, and E. M. Little.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 465, Price codes: A03 in paper copy, A01 in microfiche. Report of Navy Electronics Laboratory, San Diego, California. 33 p. Reprinted from Canadian Journal of Physics, Vol. 37, p 443-473, April 1959. 35 fig, 5 tab, 16 ref.

Descriptors: *Sea ice, *Physical properties, *Ice, *Arctic, *Canada, On-site investigations, Laboratory tests, Specific gravity, Salinity, Electrical resistance, Permeability, Strength, Shear strength, Tensile strength, Physics, *New Brunswick, *Shippegan(New Brunswick)

This preliminary study was based mostly on work done at a shore station in Shippegan, New Brunswick, during the winter of 1956-57, with some data from an ice-breaker expedition in the summer of 1956. The Shippegan site had unrafted ice, tides of 5 feet or less, and negligible freshwater runoff. The thickness of the ice was about proportional to the square root of the freezing exposure. Tritium dating of sea ice is an unsatisfactory method because of variable tritium concentration in Arctic waters. The jaggedness of ice crystals was suggested as a measure combining effects of age and thermal regime. Measurements of specific gravity, salinity, electrical resistivity, and permeability profiles all showed progressive changes in annual sea ice throughout the winter. The tensile strength of sea ice at -20 C was around 200 to 500 p.s.i. at various angles to the grain. For freshwater ice, with stress parallel to the grain, it was in the range 500 to 1000 p.s.i. Shear strengths, with the shear plane parallel to the grain, were 80 to 160 p.s.i. for sea ice at -20 C and 160 to 280 p.s.i. for pond ice, also at -20 C. (Sims-ISWS)
W79-09149

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitets vensen, Oslo.
J. E. Skorve.
Final Report, May 25, 1977. 26 p, 22 fig, 2 tab, 6 ref.

Descriptors: *Snow packs, *Snow surveys, *Remote sensing, *Runoff, *Snowmelt, River basins, Glaciers, Data collections, Satellites(Artificial), *LANDSAT imagery, *Nor-

wegian basins, *Norway, Snow line, Cumulative runoff.

Four drainage basins, less than 900 square kilometers in mountainous southern Norway, were selected for a study in snow mapping by the use of LANDSAT imagery. To get a better understanding of the snow situation, ground-based information was used. This ground-based information consisted of special snow accumulation maps issued by the Norwegian Meteorological Institute on a regular basis each winter and snow data from some weather stations. The runoff data were obtained from discharge stations near or at the base of the four basins. The observations covered the period from May 1975 to August 1976. The study showed that LANDSAT images are well suited for snow mapping in Norwegian mountainous areas. Data on variations in snow cover and runoff accumulated over several years will prove to be valuable tools in water management. (Singh-ISWS)
W79-09152

CRYOCONITE HOLES ON SERMIKAVSAK, WEST GREENLAND,
Saint Andrews Univ. (Scotland). School of Physical Sciences.
P. W. F. Gribbon.
Journal of Glaciology, Vol. 22, No. 86, p 177-181, 1979. 1 fig, 18 ref.

Descriptors: *Ice, *Glaciers, *Weathering, On-site investigations, Cold regions, Arctic, Melting, Solar radiation, Heat flow, Heat transfer, Dusts, Albedo, Glaciology, *Greenland, *Cryoconite holes.

The depths and diameters of 158 cryoconite holes were measured at 10 positions in the ablation zone of Sermikavasak, West Greenland. It was found that the depths increased on going up the glacier in agreement with other measurements made earlier on polar glaciers. There was no significant correlation of depth with diameter. The relative importance of the combined short- and long-wavelength radiation balances and the transfer of heat by convectional mixing in water-filled holes was discussed. The variations in depth were attributed to changes in the albedo and the bulk extinction coefficient of the surface ice layers on the glacier. (Sims-ISWS)
W79-09153

GRAVITATIONAL STRESSES IN FLOATING ICE SHEETS,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. J. Evans, and R. R. Parmerter.
Journal of Glaciology, Vol. 22, No. 86, p 182-185, 1979. 4 fig, 3 ref. NSF OPP71-04031.

Descriptors: *Ice, *Sea ice, *Stress, Stress analysis, Model studies, Mathematical models, Analytical techniques, Numerical analysis, Loads(Forces), Hydrostatic pressure, Gravity, Cracks, Physical properties, Gravitational stress.

This note was addressed to the determination of the in-plane components of stress in floating ice sheets due to gravity and the hydrostatic pressure in the water. The distribution and magnitude of these stresses are of interest with regard to crack propagation in sea ice. Two cases were considered. In the first, the ice sheet is formed on land by accretion at the top surface and then introduced into the water, such as happens in the Antarctic. In the second, the ice is formed in the water by accretion on the bottom, which is the usual situation in the Arctic pack ice. (Sims-ISWS)
W79-09154

ACOUSTIC EMISSION AS AN INDICATION OF STABILITY DECREASE IN FRACTURE ZONES OF AVALANCHES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
H. Gubler.
Journal of Glaciology, Vol. 22, No. 86, p 186-188, 1979. 2 fig, 3 ref.

Descriptors: *Snow, *Stability, *Avalanches, *Acoustics, Snowfall, Winds, Solar radiation, Snow cover, Mountains, Instrumentation, On-site investigations, On-site data collections.

Measurements of the event rate of natural, small-amplitude displacement accelerations in potential fracture zones of avalanches proved to be good indications for decrease of stability. (Sims-ISWS)
W79-09155

THE INTERPRETATION OF A TERTIARY TILLITE AT MOUNT FEATHER, SOUTHERN VICTORIA LAND, ANTARCTICA,
Macquarie Univ., North Ryde (Australia). School of Biological Sciences.
H. Brady, and B. McKelvey.
Journal of Glaciology, Vol. 22, No. 86, p 189-193, 1979. 3 fig, 10 ref. NSF DPP74-22894.

Descriptors: *Glaciers, *Glacial drift, *Petrography, *Antarctica, Glaciation, Rocks, Till, Sediments, Drainage, Glaciology, *Mount Feather(Antarctica).

A Tertiary tillite occurs at an altitude of 2,750 m on Mount Feather in southern Victoria Land. The tillite mantles a remnant of the floor of a southeast-trending glacial valley that pre-dates the cutting of the existing glacial drainage system in southern Victoria Land. Petrographic evidence suggests that ice which deposited the tillite drained a relatively distant source area. (Sims-ISWS)
W79-09156

2D. Evaporation and Transpiration

MATHEMATICAL DESCRIPTION OF ACTUAL EVAPOTRANSPIRATION - WITH PARTICULAR REGARD TO GRASS COVER,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Jaworski.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 17 p, 2 fig, 9 equ, 17 ref.

Descriptors: *Evapotranspiration, *Grass cover, *Simulation analysis, Meteorological data, Physiologic crop characteristics, Constant soil parameters, Precipitation, Diffusive crop resistance, Water balance, Equations, Reservoirs, Aeration zone, Computer programs, Model benefits, Mathematical models, Daily, Hourly, Systems analysis.

The proposed, physically-based model allows a correct quantitative description of actual evapotranspiration for short time intervals on the basis of meteorological data, physiologic crop characteristics and constant soil parameters. The model transforms potential evapotranspiration and real precipitation into actual evapotranspiration by means of diffusive crop resistance, the water balance equation and two fictitious reservoirs, representing the upper and lower layer of the aeration zone. The developed model is time invariant and operates with a total of seventeen parameters, from which only two are obtained in optimization process. Most parameters and functions contained in the model are physically based. The estimation of actual evapotranspiration amounts for daily or hourly time intervals enables a computer program in FORTRAN, elaborated for computers of the Odra 1305 type. The developed and experimentally tested model can be used for estimating actual evapotranspiration if an extension of a short evapotranspiration record is needed; for evaluation of changes in crop or climate on evapotranspiration amounts; for estimating and forecasting soil moisture in the aeration zone; for estimating irrigation requirements; and as a subsystem in a river catchment model or in a water resources system. (See also W79-09285) (Bell-Graf--Cornell)
W79-09298

2E. Streamflow and Runoff

POTENTIAL NONSTRUCTURAL OR LOW COST WATERWAYS SYSTEM IMPROVEMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6F.
W79-09131

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME I--EXECUTIVE SUMMARY.
IBM Corp., NY.
For primary bibliographic entry see Field 7B.
W79-09143

HYDROLOGY OF THE WEST FORK DRAINAGE OF THE GALLATIN RIVER, SOUTHWESTERN MONTANA, PRIOR TO COMMERCIAL RECREATIONAL DEVELOPMENT,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
W. A. V. Voast.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 152, Price codes: A02 in paper copy, A01 in microfiche. Research Monograph No. 9, February 1972. 19 p, 10 fig, 4 tab, 16 ref. NSF GI-38.

Descriptors: *Regional analysis, *Land management, *Aquifer characteristics, *Hydrologic systems, *Montana, Recreation facilities, Hydrology, Groundwater, Regime, Land use, *Gallatin River, *West Fork drainage.

The investigation of the hydrology of the West Fork drainage of the West Gallatin River was conducted to determine natural hydrologic conditions and to describe the natural system so that any cause-and-effect relationships of development and incipient hydrologic changes can be better understood. About 40% of the estimated average annual runoff and about 50% of the minimum daily discharge leaving the West fork originate in subdrainages where commercial recreational development is planned. The surficial aquifer and the streams are interdependent in the hydrologic system. In some places, the aquifer discharges to the stream; but in other places, the stream discharges to the aquifer. Because of their interconnection, neither streams nor the surficial aquifer can be considered as independent sources of water. Most of the water in the unconsolidated aquifer is suitable for domestic, stock, and irrigation use. (Singh-ISWS)
W79-09148

TRANSFER FUNCTION-NOISE MODEL APPLIED TO FLOW FORECASTING,
Laboratorio di Ricerca per la Protezione Idrogeologica nel Bacino Padano, Turin (Italy).
V. Anselmo, and L. Ubertini.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, 24-26 October, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 8 p, 2 fig, 10 equ, 4 ref.

Descriptors: *Streamflow forecasting, *Simulation analysis, *Transfer function-noise model, Watersheds(Basins), Reliability, Hydrologic data, Storms, Real time, Stochastic processes, Parametric hydrology, Estimating, Equations, Systems analysis.

The combined transfer function-noise model investigated by Box and Jenkins has been used to identify a model and estimate parameters for the simulation and forecasting of streamflow. The model reliability was tested with storm hourly data and recorded in three watersheds of different areas. The model proved to be satisfactory in short term (few hours) forecastings. As real time streamflow forecasting may be of practical importance, details are given about program dimensions, data requirements and job execution costs. (See also W79-09285) (Bell Graf-Cornell)

W79-09287

COMPUTER PROGRAMME ARRANGING OPTIMIZATION, SIMULATION AND COMPUTING OF FORECAST,
Institute of Meteorology and Water Management, Warsaw (Poland).
A. Baniukiewicz.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 11 p, 2 fig, 1 tab, 6 ref.

Descriptors: *Computer programs, *Optimization, *Simulation analysis, *Forecasting, Streamflow, Runoff, Mathematical models, Hydrology, Meteorology, Systems analysis.

Models for studying water runoff from basins may be used for computing the actual forecasts of water flow in rivers and for supplementing the observational sequences with the lacking flows resulting from the so-called simulation. Such calculations must be preceded by adjustment of the model to a given river basin, and this is most frequently accomplished through optimization of model parameters. (See also W79-09285) (Bell Graf-Cornell)
W79-09288

EFFICIENCY OF THE REAL-TIME HYDROLOGICAL FORECASTING SYSTEMS IN POLAND AFTER SYSTEM OPERATION IN 1975-77,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2A.
W79-09289

DIFFUSION EQUATION AS A IMPULSIVE RESPONSE FOR THE FLOOD EVENTS MODELLING,
Hydrometeorologicky Ustav, Prague (Czechoslovakia).
For primary bibliographic entry see Field 2A.
W79-09291

ROUTING OF FLOOD EVENTS OF SPECIFIED PROBABILITY IN RESERVOIR SYSTEMS IN THE PREALPINE REGION,
Bayerische fuer Landesamt Wasserwirtschaft, Munich (Germany, F.R.).
P. Handel, and R. P. Spiegel.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 12 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Flood routing, *Reservoirs, *Hydrographs, *Computer programs, *Simulation analysis, Discharge(Water), Dams, Reservoir operation, Flood event, Prealpine region(W. Germany), Storage cascade, Data requirements, Hydrology, Mathematical models, Systems analysis.

Flood protection problems arise in the design of hydraulic structures. Using flood routing procedures, known flood hydrographs can be routed along the river in order to obtain hydrographs at the selected location. If there is a reservoir or a cascade of reservoirs in the river, the deformation of the wave by reservoir operating strategies has to be considered. Larger and faster computers have challenged engineers to develop more precise and sophisticated models. But great amounts of data required and of computer storage and time needed can restrict general application of these models. Therefore, a suite of four independent programs has been developed with special emphasis on low computer requirements and smaller data needs. The programs are successively compiled and executed; results are filed as input for successive programs. For comparison, the calculations were implemented on the TR 440 and the CYBER 175. To make efficient use of existing subroutines, the respective programs were programmed in Algol 60 or Fortran IV. A reach of the Lech River was chosen for demonstration. By means of the analytic hydrograph function which implicitly includes the four flood parameters, the storage cascade can be simulated. (See also W79-09285) (Bell-Graf--Cornell)
W79-09312

2F. Groundwater

GEOHYDROLOGY OF COMAL, SAN MARCOS, AND HUECO SPRINGS.
Texas Department of Water Resources, Austin.
Report 234, June 1979. 92 p, 27 fig, 6 tab, 153 ref.

Descriptors: *Texas, *Springs, *Water resources, *Hydrogeology, Spring waters, Data collections, Water quality, Discharge(Water), Aquifers, Recharge, Natural recharge, Streams, Water temperature, Chemical analysis, Water levels, Geology, Withdrawal, Groundwater resources, Precipitation(Atmospheric), Dissolved solids, Hardness(Water), *Comal Spring(TX), *San Marcos Spring(TX), *Hueco Spring(TX), *Edwards aquifer(TX).

The purpose of this report was to document information now available on Comal, San Marcos, and Hueco Springs, and to define the geologic and hydrologic conditions under which the springs occur. In their upper reaches, the Guadalupe, San Antonio, and Nueces River basins are crossed and hydrologically connected by the Edwards (Balcones Fault Zone) aquifer, which is the principal source of water supplies for Uvalde, Sabinal, Hondo, San Antonio, New Braunfels, San Marcos, and other users in this area. The aquifer receives water principally by infiltration from the streams which cross it. The water in the aquifer moves generally from west to east, across the lines of surface drainage divides, and is discharged through wells and springs en route. Comal, San Marcos, and Hueco Springs are in the eastern part of the aquifer of the aquifer. This investigation included a compilation of historical records of the flow of Comal, San Marcos, and Hueco Springs, the quality and temperature of the water, measurements of tritium contents of the water, and an evaluation of the hydrologic meaning of these measurements. Existing knowledge of correlations of the spring flows with water levels in wells, pumpage, recharge, and streamflow was compiled, and representative data were presented and discussed. Recharge areas for the three groups of springs were described. The possibilities of contamination of the water issuing from the springs were discussed. Recommendations were made for additional research and observations in the future. (Humphreys-ISWS)
W79-09139

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS,
Texas Water Development Board, Austin.
S. W. Gammon, and W. R. Muse.
Report 21, April 1966. 543 p, 48 ref.

Descriptors: *Water levels, *Fluctuations, *Observation wells, *Texas, Wells, Maps, Hydrographs, Precipitation(Atmospheric), Data collections, Data processing, Measurement, Groundwater, Aquifers, Drawdown, Hydrogeology.

Evaluation of water level records is an integral part of every groundwater investigation. Water level records of an aquifer reflect the amount of water in storage and changes in storage as well as direction and rate of water movement. Consequently, compilation of water level data from selected wells on a long-term basis is essential. Tabulated in this report were records of water levels from observation wells for 29 counties of the Southern High Plains. These listings provide the following information: well number, depth of well, elevation of land surface in feet above mean sea level, dates of measurement, measurements of water level in feet below land surface, and changes (decline or rise) in water level from the previous year's measurement. These tables are reproduced from direct printouts of electronic data processing equipment. Preceding the table for each county is a well-location map. A well symbol and the last 3 digits of the well number appear on the map at the location of each well listed in the county tabulation. Hydrographs, showing changes in water level, were presented for selected representative wells following the respective county tabulations. (Sims-ISWS)
W79-09141

GROUNDWATER FLOW TO A DEEP WELL NEAR A RECTILINEAR CHANNEL,
Institute for Land and Water Management Research, Wageningen (Netherlands).
L. F. Ernst.
Journal of Hydrology, Vol. 42, No. 1/2, p 129-146, June 1979. 14 fig, 2 tab, 24 ref.

Descriptors: *Groundwater movement, *Mathematical models, *Channels, *Wells, Pumping, Theoretical analysis, Equations, Flow, Water table, Homogeneity, Drains, Flow nets, Boundaries(Surfaces), Model studies, *Image wells, Partial penetration.

In this paper a theoretical analysis was given of the groundwater flow in a homogeneous aquifer to a deep well in the proximity of a rectilinear canal. The resulting formulas were applicable, for a large part, both to steady and non-steady states. (Visocky-ISWS)
W79-09159

STEP-DRAWDOWN PUMPING TESTS FOR THE DETERMINATION OF AQUIFER AND BOREHOLE CHARACTERISTICS,
Water Research Centre, Marlow (England). Resources Div.
N. R. Brereton.
Technical Report TR 103, January 1979. 29 p, 10 fig, 4 tab, 16 ref.

Descriptors: *Aquifer characteristics, *Drawdown, *Aquifer testing, *Analytical techniques, Groundwater, Mathematical models, Boreholes, Water yield, Water wells, Pumping, Theoretical analysis, Withdrawal, Transmissivity, Storage coefficient, On-site tests, Analysis, Step-drawdown tests.

This report discussed the theoretical and practical aspects of short duration (one day) step-drawdown pumping tests. Analysis of the tests results (1) indicated the maximum yield for a given drawdown that can be operated from a well after any given period of pumping; (2) helped define the hydraulic rating of the pumping installation; (3) measured the hydraulic efficiency of the well and identified possible causes of high operating costs; and (4) monitored the long-term behavior of the well and identified possible reasons for a decline in well yield. It was concluded that when carried out in conjunction with the conventional constant-rate test, a step-drawdown test will lead to a much greater understanding of the behavior of both the well and the aquifer. Neither method gives enough information to determine head loss through the screen or pack of the abstraction well. (Humphreys-ISWS)
W79-09163

2G. Water In Soils

ESTIMATION OF THE LONGITUDINAL DISPERSION AND SORPTION COEFFICIENTS IN SATURATED SOILS BY STRAIGHT-LINE METHODS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.).
For primary bibliographic entry see Field 5B.
W79-09158

INFILTRATION DYNAMICS UNDER VARIOUS RANGELAND TREATMENTS ON UNIFORM SANDY-LOAM SOILS IN SOUTHEASTERN UTAH,

Utah State Univ., Logan. Watershed Science Unit.
G. F. Gifford.
Journal of Hydrology, Vol. 42, No. 1/2, p 179-185, June 1979. 8 fig, 1 tab, 6 ref.

Descriptors: *Infiltration, *Range management, *Utah, *Soils, Seasonal, Pinyon pine trees, On-site investigations, Grazing, Juniper trees, Sampling, Freeze-thaw effects.

Studies were made, over a 3- to 8-yr period, of mean seasonal and yearly changes in infiltration rates under various rangeland management practices within the pinyon-juniper type. Results of the study indicated that mean upper limits in measured infiltration rates range from a surprising 1.37-3.47 times the mean minimal rates, each mean value representing from 6-20 replications for a given sampling date. Soil biology may be important in determining seasonal trends in infiltration rates, as well as over-wintering freeze-thaw activity. Suggestions were given for sampling infiltration rates. (Visocky-ISWS)
W79-09160

PHYSICAL MODEL OF THE HYDROLOGY OF SLOPING HETEROGENEOUS FIELDS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
D. Hillel, and G. M. Hornberger.
Soil Science Society of America Journal, Vol. 43, No. 3, p 434-439, May-June 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Soil water movement, *Field capacity, *Model studies, Physical properties, Hydrology, Surface runoff, Slopes, Water storage, Heterogeneity, Storage, Soils, Flow, *Soil water dynamics, *Field water cycle, Dynamic simulation, Physical model, Sloping heterogeneous fields, Watershed dynamics, Unified approach.

A model simulating water flow and storage in a two-dimensional section of a sloping field, in which surface runoff, infiltration, evaporation, unsaturated soil moisture movement, and groundwater flow were represented as a series of interacting one-dimensional processes, was adapted to cases of horizontally heterogeneous fields. The model was illustrated in a series of simulation trials with variously constituted hypothetical fields of loam and clay soils, subjected to a 108-mm rainstorm. Runoff was found to depend on the fraction of the slope occupied by clay and on the relative location of the clay (whether upslope or downslope with respect to the loam). Groundwater recharge was found to be greater in the loam, as was the rate of lateral drainage. The capability of the model was discussed. (Roberts-ISWS)
W79-09161

STATUS OF INORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 3C.
W79-09234

2H. Lakes

SECONDARY PRODUCTIVITY OF THE NORTH PINE DAM,
Queensland Inst. of Tech., Brisbane (Australia). Dept. of Biology.
C. R. King.
Australian Water Resources Council Technical Paper No. 39, 1979. 90 p, 19 fig, 18 tab, 123 ref, 1 append. Australian Government Publishing Service, Canberra.

Descriptors: *Zooplankton, *Benthos, *Reservoirs, Aquatic animals, Aquatic life, Plankton, Copepods, Australia, Dams, Crustaceans, Rotifers, Aquatic microorganisms, Invertebrates, Diptera.

The monitoring of the filling stages of the North Pine Dam and observations regarding the establishment and activity of colonizing zooplankton and macrozoobenthic communities are reported. Samples of zooplankton populations were collected monthly from three sites for almost three years. Three Eckman-Birge grab samples for macrozoobenthos were taken at each of ten sites over one year. Twelve species of zooplankton had established viable and dominant populations in the lake by the end of 1976, when the lake reached full supply level. The twelve species included seven rotifers, two copepods, and three clodocerans. The dominant macrozoobenthic group was chironomids, which accounted for 95% biomass and production. Most zooplankton species conformed to seasonal patterns but major physical changes to the lake system modified the patterns. Zooplankton usually formed less than 1% of the particulate organic carbon and less than 5% of the particulate organic nitrogen and particulate phosphorous in the water. Figures are given for average annual standing crops, and production of zooplankton and macrozoobenthos; tonnes of carbon, nitrogen, and phosphorus processed are also given. (Schaefer-IPA)
W79-09084

A NUMERICAL HINDCAST MODEL FOR WAVE SPECTRA ON WATER BODIES WITH IRREGULAR SHORELINE GEOMETRY; REPORT 2, MODEL VERIFICATION WITH OBSERVED WAVE DATA,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
D. T. Resio, and C. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A064 992, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper H-77-9, December 1978. 55 p, 4 tab, 9 ref.

Descriptors: *Waves(Water), *Great Lakes, *Mathematical models, *Wave spectra, *Hindcasting.

The procedures used to verify a numerical model for wave generation in water bodies of arbitrary shape are described. The verification results for Lakes Erie, Ontario, and Superior are presented. Parameters in the study include significant wave height and frequency at the spectral peak. Examples of hindcast and measured one-dimensional (frequency) spectra are given. The study indicates a capability of the model to hindcast significant wave height such as root-mean-square error of about 1.5 ft and to hindcast the period of peak frequency with a root-mean-square error of 1 sec. These errors include effects from both the wave model and the hindcast model used to estimate the windfield. (WES)
W79-09094

EVALUATION OF THE CHLOROPHYLL CONCENTRATION TO PREDICT THE TROPHIC STATE OF LAKES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 5B.
W79-09142

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 7, FLOOD CONTROL BY RESERVOIRS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 4A.
W79-09145

EAGLE LAKE POLLUTION CONTROL PROJECT: ASSESSMENT OF LAKE IMPROVEMENT,
Minnesota Univ., Morris. Div. of Science and Mathematics.
J. J. Latterell, R. S. Abbott, T. E. Straw, J. B. Van Alstine, and C. F. Myette.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 148, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Minneapolis. Bulletin 100, June 1979. 126 p. 25 fig, 38 tab, 47 ref. OWRT A-999-MINN (49), 14-34-0001-8025.

Descriptors: Community action, *Sewage disposal, Nutrients, Limnology, *Lake sediments, Water balance, Eutrophication, Eagle Lake(MN).

In this study of the response of Eagle Lake, Kandiyohi County, MN, to the removal of septic effluent, detailed studies of the biological, chemical, sedimentological, hydrological and physical conditions in the lake were conducted. Comparisons of the data collected in this fifth year study were made with bench mark data. An annual hydrologic budget for Eagle Lake was prepared for the 1978 water year. Results show that the amount of water that flowed through Eagle Lake in the 1978 water year was 6,719 acre-feet. Inflow to the lake comprised 45 percent surface water, 22 percent ground water, and 33 percent precipitation. Water out of the system comprised 72 percent surface water, less than 1 percent ground water, 25 percent evaporation, and slightly greater than 2 percent net change in lake storage. Several observations give evidence of an improvement in the quality of Eagle Lake waters after the installation of a peripheral sewage collection line. One such observation is the decrease in total nutrient loads of nitrogen and phosphorus at the spring turnover 1978. However, increases in the phytoplankton biomass and the shifts in the most abundant species with the blue-green algae assuming dominance do not indicate an improvement in water quality. The interpretation of observations has been complicated by the increased nutrient load of the surface water inlets, especially that which resulted from unseasonable heavy rains flushing large quantities of nutrient rich and biologically active waters stored behind a beaver dam during weeks 24 to 28, 1978.
W79-09232

2I. Water In Plants

MECHANICAL HARVESTING OF AQUATIC PLANTS; REPORT 1, FIELD EVALUATION OF THE AQUA-TRIO SYSTEM,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. M. Culpepper, and J. L. Decell.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 932, Price codes: A06 in paper copy, A01 in microfiche. Technical Report A-78-3, October 1978, in two volumes. 406 p, 6 append, 2 pl, 7 tab, 36 ref.

Descriptors: *Aquatic plants, *Aquatic weed control, *Harvesting, *Aqua-Trio.

The U.S. Army Engineer District, Jacksonville, is instituting environmentally compatible, large-scale aquatic plant control and management programs. Local opposition to the use of chemicals to control waterhyacinths and the lack of a federally registered chemical to control the submersed aquatic plant hydrilla prompted the Jacksonville District to request that the U.S. Army Engineer Waterways Experiment Station evaluate the most advanced off-the-shelf aquatic plant harvesters and harvesting systems. The only equipment found with the potential to meet specified requirements is a three-component mechanical harvesting system, known as the Aqua-Trio, manufactured by Aquamarine Corporation of Waukesha, Wisc. This report reflects the results of the field data collection program and the analysis of the equipment performance. The main text and Appendixes A-E are contained in Volume I. Volume II contains Appendix F, which is a compilation of all data taken and equipment operating times recorded during the field operation. (WES)
W79-09093

2J. Erosion and Sedimentation

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,
Corps of Engineers, Washington, DC. Beach Erosion Board.
For primary bibliographic entry see Field 2L.
W79-09138

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1971-SEPTEMBER 1975,
Texas Dept. of Water Resources, Austin.
J. P. Dougherty.
Report 233, May 1979. 88 p, 1 fig.

Descriptors: *Sediment discharge, *Suspended load, *Data collections, *Texas, Suspended solids, Sediments, Sediment transport, Streamflow, River basins, Water year, On-site data collections, Rivers, Reservoirs.

This report was a supplement to Texas Water Development Board Reports 184, 106, and 45, Texas Water Commission Bulletin 6410, and Texas Board of Water Engineers Bulletin 6108. These prior publications presented the results of suspended-sediment load measurements at permanent observation points from the beginning of record through the 1971 water year. No reconnaissance-type determinations of short-period record or intermittent record were compiled. During the period covered by this report, 39 suspended-sediment sampling stations were operated in 12 river basins. No attempt was made to include that sediment which may be moved by a flowing stream along its bottom, commonly referred to as 'bed load.' Presented with the sediment data obtained for the 1972 through 1975 water years was a summary table showing maximum, minimum, and average annual suspended-sediment transport passing each gaging point for a total period in full water years. Monthly values of sediment conversions to acre-feet were rounded to the nearest whole number and were based on a density of 70 pounds per cubic foot. (Humphreys-ISWS)
W79-09140

LABORATORY MEASUREMENTS OF UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF CALVERT, BALL, JORDAN, AND FELDSPAR SOIL SEDIMENTS,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
For primary bibliographic entry see Field 7B.
W79-09150

PROBLEM ASSESSMENT REPORT: SOIL EROSION SUBCOMMITTEE--ILLINOIS AGRICULTURAL TASK FORCE ON NON-POINT SOURCES OF POLLUTION.
Illinois Inst. of Natural Resources, Springfield.
Final Report, Soil Erosion Subcommittee, April 24, 1978. 76 p, 7 fig, 17 tab, 69 ref.

Descriptors: *Sedimentation, *Erosion, *Sediments, *Suspended solids, *Illinois, Turbidity, Nutrients, Nitrogen, Phosphorus, Potassium, Surveys, Sampling, Soil erosion, Agriculture, Bacteria, Pollutants, Path of pollutants, Sediment transport, Streams, Rivers, Lakes, Land use, Aquatic habitats.

Before Illinois was widely settled, the rivers and streams were usually described as being clear. The land was generally vegetated with forest and prairie that soaked up rainfall and released water slowly to streams and springs during dry seasons. Even with the development of agriculture in Illinois, many streams remained relatively clear until some time after 1900. The results of sedimentation surveys showed that there are regional differences in the sediment yields of different regions of the state. The sediment yield of the Galesburg Plain area is much higher than that of the Springfield Plain, or of the claypan soils. In most lakes, streams, and rivers in Illinois, turbidity produced by suspended sediment at certain times of the year is well within the range of 20 to 100 Jackson Turbidity Units--a range which is known to cause undesireable changes in aquatic life. Turbidity varies with the weather and the season. Sheet and rill erosion occurring on agricultural land is by far the largest source of sediment in Illinois. Urban land and land where mining or oil extraction is taking place may also suffer from erosion but are a source of less sediment than sheet and rill erosion. Gully and stream-bank erosion can occur on any land, but sediment arising from this source is minor in relation to the total. However, sediment from any source can cause severe problems at a specific location. Certain conservation practices can be applied to nearly level lands to reduce losses from soil erosion below the present level. However, these practices must be designed to maintain adequate drainage on such soils, which have an inherent drainage problem; otherwise, crop yields will be reduced. (Sims-ISWS)
W79-09164

MULTIPLE REGRESSION TECHNIQUE FOR ESTIMATION OF SUSPENDED SEDIMENT TRANSPORT IN KIZINGA RIVER OF COASTAL TANZANIA,
Dar es Salaam Univ. (Tanzania).
J. I. Matondo, and S. V. K. Sarma.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 17 p, 2 fig, 3 tab, 4 equ, 8 ref.

Descriptors: *Regression analysis, *Estimating, *Suspended sediment transport, *Hydrology, *Kizinga River basin(Tanzania), Coastal areas, Stochastic processes, Semi-arid basins, Groundwater resources, Watersheds(Basins), Simulation analysis, Mathematical models, Storm runoff, Hydrographs, Equations, Walling's approach, Hydraulics, Systems analysis.

Stochastic empirical models as applied to hydrological problems have been discussed. The hydrology of the Kizinga basin has been explained. The utility in applying multiple regression analysis for estimating suspended sediment in rivers is demonstrated, with reference to semi-arid basins of Coastal Tanzania. As the Kizinga River is a low-land stream with fine sand transport, the basin's potentiality as a groundwater resource has been stressed. The hydraulic theory of bed material transport is helpful but inadequate, so resort is made to investigate allied factors affecting the hydrology of the watershed by considering the individual storm events which result in single-peaked runoff hydrographs. In the present analysis, Walling's approach for small watersheds is made use of and the resulting equation--connecting the suspended load concentration expressed as percent of bed load by weight with the parameters describing rising or falling limbs of a storm runoff hydrograph--has been tested for its validity. The physical significance of the parametric variables has been explained. The regression equation enables one to calculate the relative amount of sediment transported at a given level of storm flow occurring at the time of sampling. A practical illustrative example has been furnished giving details to work out the coefficients. (See also W79-09285) (Bell-Graf--Cornell)
W79-09295

2L. Estuaries

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,
Corps of Engineers, Washington, DC. Beach Erosion Board.
R. A. Jachowski.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 880, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper No. 2-59, May 1959. 32 p, 5 fig, 3 tab, 1 ref, 1 append.

Descriptors: *Groins(Structures), *Maryland, *Beaches, *Beach erosion, *Erosion control, Coasts, Coastal structures, Coastal engineering, Sands, Asphalt, Waves(Water), Ocean waves, Storms, Hurricanes, Erosion, Littoral drift, Engineering, *Ocean City(MD).

The ocean shore of Maryland northward from Ocean City to the Delaware State line has had a history of erosion over the past century. In 1954 and 1955, the Maryland State Roads Commission desired to stabilize this shore, and with limited funds available decided to experiment with sand-asphalt construction for a groin system. Although the groins were constructed with approximately 50% of their height (the highest being 3 1/2 to 4 feet) buried below the beach surface, storm wave profile adjustments caused exposure of the crowns and aprons of the groins. As a result, the groins were undermined and settled or were destroyed. After the storms, the beach slope readjusted and covered the seaward section of the groin, which had settled. With this portion of the crown covered, the groins were not able to retain littoral material. Three years after construction (October 1957) only 5 of the 43 groins were exposed above the beach level in the foreshore zone. The net effect of the entire groin system on the shore at the end of 3 years appears to have been negligible. The behavior of the sand-asphalt groins of the type used to date demonstrates definite limitations of effectiveness. Modification of design as to mix, dimensions, and sequence of construction may reveal a different behavior. (Sims-ISWS)
W79-09138

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME VI, APPENDIX 7, WATER QUALITY.
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 5A.
W79-09146

MODELLING THE WATER QUALITY IN NEVA BAY,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 5B.
W79-09326

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF LOW PRESSURE BRACKISH-WATER REVERSE OSMOSIS MEMBRANES,
Abcor, Inc., Wilmington, MA. Walden Div.
R. L. Goldsmith, B. A. Wechsler, D. C. Grant, R. B. Parker, and M. H. Kleper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 226, Price codes: A06 in paper copy, A01 in microfiche. Final Report, July 1979. 98 p, 45 fig, 6 append. OWRT (No. 7509)(1). 14-34-0001-7509(1).

Descriptors: *Membrane processes, *Reverse osmosis, *Brackish water, Demineralization, *Membranes, *Polybenzimidazolone, Optimization, Spiral module, Development, Evaluation.

Flat-sheet reverse osmosis membranes were developed for low pressure, brackish-water desalination from a novel, aromatic polymer polybenzimidazolone (PBIL). This polymer, developed in Japan, had been previously shown to have potential when formed into a seawater desalting membrane. Membrane formation conditions were systematically varied in order to tailor membrane characteristics to applications in brackish-water desalting. This work resulted in the formation of membranes with initial fluxes of 15-16 gfd and salt rejections of 90-95% using 0.5% sodium chloride at 250 psig and 25 C. Following the laboratory work, flat-sheet membrane was manufactured for fabrication of 2-inch diameter spiral-wound reverse osmosis modules. Although newly-manufactured membrane gave fluxes of 13 gfd or greater and rejections of 90%, results for modules were typically 5-7 gfd and 80-85%. Membrane performance losses during shipment, storage and module fabrication appeared to predominate in determining module performance although structural considerations in the modules themselves were also a factor.
W79-09314

3B. Water Yield Improvement

LEGAL IMPLICATIONS OF INCREASING THE AVAILABILE WATER,
Blatchley Associates, Inc., Denver, CO.
For primary bibliographic entry see Field 6E.
W79-09173

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 6E.
W79-09175

3C. Use Of Water Of Impaired Quality

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 6E.
W79-09175

STATUS OF INORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
L. E. Sommers, D. W. Nelson, and L. B. Owens.
Soil Science, Vol. 127, No. 6, p 340-350, June 1979. 3 fig, 7 tab, 31 ref. OWRT B-075-IND (3).

Descriptors: *Phosphorus, *Soils, *Irrigation, *Waste water(Pollution), *Pennsylvania, Carbon, Nitrogen, Effluents, Sampling, Leachate, Sorption, Water reuse, Laboratory tests, Wastewater irrigation.

A cooperative study was conducted with Pennsylvania State University to assess the effects of wastewater irrigation on the status of soil phosphorus. The major objective of the research was to evaluate the influence of wastewater irrigation on changes in soil organic carbon, nitrogen, and phosphorus and the sorption of orthophosphate (P). Soil samples were obtained in 1974 and 1975 from Hublersburg silty clay loam cropped to corn, Reed canarygrass, or a mixed forest and from a Morrison sandy loam with a mixed forest stand. The sites had been irrigated with secondary effluent for 11 to 12 years. Soil analyses indicated that the majority of phosphorus added to soils during wastewater irrigation remained in the upper 30 cm of the Hublersburg clay loam soil. In contrast, appreciable amounts of P had leached to the 30 to 60-cm depth in the Morrison sandy loam. The equilibrium phosphate concentration (EPC) increased markedly at the 0 to 15-cm depth as a result of wastewater irrigation, due to sorption of P added in the wastewater. As expected, the maximum P sorption capacity of soils was decreased by wastewater irrigation. A comparison of soluble P levels in leachate samples collected in the field at a 120-cm depth with soluble P predicted by EPC measurements indicated that laboratory measurements overestimate the ability of a soil to remove P from wastewater. (Viscocky-ISWS)
W79-09234

3D. Conservation In Domestic and Municipal Use

CONSERVATION ECONOMICS OF HAWAII'S SYSTEM OF WATER RIGHTS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W79-09182

3F. Conservation In Agriculture

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09181

THE ECONOMIC IMPLICATIONS OF EROSION AND SEDIMENTATION CONTROL PLANS FOR SELECTED PENNSYLVANIA DAIRY FARMS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
G. B. White, and E. J. Partenheimer.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 341-357, 1979. 6 tab, 8 ref.

Descriptors: *Erosion control, *Sediment control, Economic impact, *Dairy industry, Water law, Soil conservation, Linear programming, *Pennsylvania.

Amendments to the Clean Streams Law of Pennsylvania required the state's agricultural landowners to have erosion and sedimentation control plans implemented by July 1, 1977. The purpose of this research was to investigate the effects of implementation on the income of commercial dairy farms. The research focused on conservation plans made by the Soil Conservation Service (SCS) for twelve case study farms. Linear programming was used to estimate returns to fixed resources and farm organization for three plans for each farm. These included the base plan, before implementation of the SCS plan; the farm plan incorporating SCS recommendations; and a plan incorporating no-till corn production as an alternate or supplement to other conservation practices. (See also W79-09185) (Skogerboe-Colorado State)
W79-09210

FARM-LEVEL ECONOMIC EVALUATION OF EROSION CONTROL AND REDUCED CHEMICAL USE IN IOWA,
Iowa State Univ., Ames. Dept. of Economics.
J. M. McGrann, and J. Meyer.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 359-372, 1979. 1 fig, 3 tab, 11 ref.

Descriptors: *Erosion control, Fertilizers, Pesticide toxicity, *Water pollution sources, Economic impact, Model studies, Linear programming, Terracing, Institutional constraints, *Iowa, Nonpoint sources.

This study concentrated on the farm-level economic impact of soil loss control and reduced chemical use. The farms analyzed are typical of three major soil associations in Iowa which cover a wide spectrum of farming conditions in the state. The analysis investigated the impact of restricting soil loss from the present to several reduced levels on net farm income and land rents for both specialized crop and mixed crop and livestock farms. The waste disposal problem of the limited sized livestock enterprises was not addressed in this study. A limited analysis was made of the effect that reducing fertilizer and banning pesticide use would have on farm income as an alternative to reduce nonpoint pollution. Policy alternatives to control erosion, including tax rates to achieve reduced soil loss and cost-sharing schemes for terracing, were evaluated in farm-level models. Consideration was also made as to how information generated in the study can be used for extensionist and farmer training. (See also W79-09185) (Skogerboe-Colorado State)
W79-09211

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 7, FLOOD CONTROL BY RESERVOIRS,
Hydrologic Engineering Center, Davis, CA.
L. R. Beard.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 598, Price codes: A06 in paper copy, A01 in microfiche. Report HEC-IHD-0700, February 1976. 98 p, 19 fig, 8 tab, 12 ref, 1 append.

Descriptors: *Flood control, *Reservoir operation, *Spillways, *International Hydrological Decade, Runoff, Storm runoff, Snowmelt, Storage capacity, Reservoirs, Design, Reservoir design, Inflow, Discharge(Water), Structures, Outlet works, Mathematical models, Computer models, Analytical techniques, Rule curves.

This was Volume 7 of a 12-volume report prepared by The Hydrologic Engineering Center as a part of the Army Corps of Engineers' contribution to the International Hydrological Decade. Basic principles of reservoir operation for flood control were presented, and procedures for establishing operational criteria were described. Topics included determination of reservoir release rates, regulation of the reservoir design flood, considerations for determining outlet and spillway regulation, determination of rule curves, and procedures for analyzing multiple-reservoir operation. The applicability of computer simulation for establishing operational criteria was discussed. (Sims-ISWS)
W79-09145

STATE WATER LAWS: EFFECT ON ENGINEERING SOLUTIONS,
Army Engineer District, Galveston, TX.
C. E. Reinke, and R. C. Allison.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 204-218, 1979.

Descriptors: *Surface-groundwater relationships, *Water supply development, *State governments, *Water conservation, Water law, Water management, Water policy, Water pollution control, Aquifers, Surface waters.

Present state water rights laws generally address surface and groundwater as separate resources. This tends to discourage exercize of the best possible water resource management. This results in inefficient utilization of surface water and drainage of groundwater aquifers without constraints. Current state water rights laws were developed when people were not concerned with the interrelationship between surface and groundwater. The states were concerned only with determining who was entitled to the use of these waters. This was accomplished by surface water rights laws which were based on riparian rights or appropriation rights. Groundwater rights laws either followed the common law rule of absolute ownership or the doctrines of reasonable use and correlative rights. State water rights laws that treat surface and groundwater as distinct resources are no longer reasonable, since engineering advancements have disclosed the interrelationship and interdependence of all waters. Revisions of state water laws are suggested which would require conjunctive use of surface and groundwater in the interest of efficiency and conservation. (Vloedman-Florida)
W79-09179

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W79-09180

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09181

BYZANTINE DRAINAGE LAW: PENNSYLVANIA'S EXPERIENCE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 6E.
W79-09183

SIMULATION OF THE WATER MOVEMENT AND THE CHLORIDE CONTENT IN A CANAL-OPEN RESERVOIR SYSTEM,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Engineering.
B. H. Tangena, J. G. de Graan, and F. Langeweg.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 20 p, 8 fig, 18 equ, 1 append.

Descriptors: *Simulation analysis, *Water movement, *Chloride content, *Reservoirs, *Twente Canal(The Netherlands), *Mathematical models, *Hydrologic data, Computer programs, Reservoir operation, Water balance, Statistical methods, Logistics, Drinking water, Flow, Sensitivity analysis, Equations, Systems analysis.

In order to study the possibilities of a surface water reservoir, for drinking water supplies, in the Twente district in the Netherlands, which is fed by the Twente canal or Twentes' brooks, a mathematical model was developed. The model describes the flow and chloride concentration in the canal and the reservoir as a function of time. Input data are measured hydrological data generated over a period of 37 years. The model seems quite insensitive to inaccuracies in this data. By verification, the model gives a very reasonable description of reality, both with relation to the water and the chloride balance. It is concluded that based on the model computations, reliable pronouncements can be made for expected level fluctuation and spanning periods in a reservoir in the Twente district. (See also W79-09285) (Bell-Graf--Cornell)
W79-09301

A COMPUTER SIMULATION MODEL FOR THE MANAGEMENT OF LAKE MAGGIORE WATER SYSTEM,
Politechnico di Milano (Italy). 1st. di Elettrotecnica ed Elettronica.
G. Ambrosino, G. Fronza, and R. Soncini-Sessa.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprintsj of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 20 p, 7 fig, 3 tab, 9 ref, 5 equ.

Descriptors: *Simulation analysis, *Computer models, *Management, *Lake Maggiore(Italy), Regulation, Least squares method, Effects, Reservoir releases, Floods, Recreation, Mathematical models, Systems analysis, Equations, Multiple-purpose reservoirs, Operating rule, Interpretative model.

This paper describes an interpretative model of the present 'empirical' regulation of the Lake Maggiore system. Precisely, the existence of an operating rule in the form of a complex multiseasonal yield-level relationship is postulated, and the rule is identified out of past management figures via a modified least squares interpolation technique. Then the model, suitably adjusted, is run in order to point out the effects (on downstream release deficit as well as on floods on the lake sides, where recreational activities are located) of enhancing the present regulation range, namely the range above which the outflow gates must be kept open by law. (See also W79-09285) (Bell-Graf--Cornell)
W79-09306

LEGAL RESTRAINTS AND RESPONSES TO THE ALLOCATION AND DISTRIBUTION OF WATER,
Denver Univ., CO.
For primary bibliographic entry see Field 6E.
W79-09316

TRANSMOUNTAIN DIVERSIONS OF WATER IN COLORADO,
Moses, Wittemeyer, Harrison and Woodruff Boulder, CO.
For primary bibliographic entry see Field 6E.
W79-09318

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
G. Sarlie, and G. Wallace.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 414, Price codes: A04 in paper copy, A01 in microfiche. September, 1976, 47 p.

Descriptors: *Washington, *Water rights, *Water resources, *Water management, Legislation, Water policy, Water allocation, Groundwater, State governments, Water conservation.

In April, 1976, Governor Evans of Washington initiated a statewide Policy Analysis Process. It requested that state agencies devote a part of their analytical resources to policy questions of special importance to central management decisions. This report is a response to a request for a water rights issue analysis. The analysis includes the increasing problems surrounding the water rights question and the need for reassessment of the use of public waters, and recommendations aimed at improving water right management. At the time this report was being written, the Department of Ecology adopted chapter 173-596 WAC, Procedures and Policies Governing Appropriations of Significant Amounts of Water for Agricultural Irrigation Use. This term permit regulation answers many questions concerning water right management. The report contains a copy and an explanation of chapter 173-596 WAC. Also included is a copy of Washington's 1971 Water Resources Act, which sets forth fundamentals of water resource policy to insure the protection and full utilization of the state's water. A brief history of Washington's water rights is presented. (Vloedman-Florida)
W79-09319

4B. Groundwater Management

GEOMORPHIC PERSPECTIVE ON SHALLOW GROUNDWATER POTENTIAL, COASTAL NORTH-EASTERN TASMANIA,
Tasmania Univ., Hobart (Australia). Dept. of Geography.
A. R. Bowden.
Australian Water Resources Council Technical Paper No. 36, 1978. 87 p, 37 fig, 8 tab, 42 ref. Australian Government Publishing Service, Canberra. 75/84.

Descriptors: *Groundwater potential, *Groundwater mining, *Water supply, Geomorphology, Geology, Water utilization, Australia, Groundwater, Pumping, Irrigation water, Tasmania, Flow, Aquifers, Groundwater resources, Excavation, Tomahawk Formation, Barnbougle Member.

Hydrological processes in coastal areas of north-eastern Tasmania were studied, and coastal sediment bodies were classified as potential aquifers on the basis of their form, stratigraphy, sedimentary, and physical characteristics insofar as these properties can be related to the storage transfer and yield of groundwater. Mapping and description of landforms and deposits was followed by intensive examination of the hydraulic properties of the sedimentary body which was expected to have the highest potential as a groundwaters reservoir. The groundwater potential of the Tomahawk Formation and Barnbougle Member were highlighted by the study. The Tomahawk Formation has sufficient groundwater to supplement the relatively low summer rainfall; this water is near the surface. The Barnbougle Member has abundant water of a potentially higher quality than that of the Tomahawk Formation. An efficient pumping method utilized 5 cm diameter wire around screens jetted into the sand. An array of screens in areas where sands are more than 4 m thick, each yielding 20,000 liters/day, would provide ample local irrigation water. Shallow excavations for livestock watering should be carried out when the water table is very low. (Schaefer-IPA)
W79-09081

STATE WATER LAWS: EFFECT ON ENGINEERING SOLUTIONS,
Army Engineer District, Galveston, TX.
For primary bibliographic entry see Field 4A.
W79-09179

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W79-09180

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09181

STATUS OF INORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 3C.
W79-09234

THE USE OF A GROUNDWATER MODEL IN THE DESIGN, PERFORMANCE ASSESSMENT AND OPERATION OF A RIVER REGULATION SCHEME,
Water Research Centre, Marlow (England). Medmenham Lab.
M. W. Liddament, D. B. Oakes, A. C. Skinner, and W. B. Wilkinson.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Univesita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 24 p, 8 fig, 2 equ, 6 ref.

Descriptors: *River regulation, *Groundwater, *Mathematical models, *Design, *Performance assessment, *Management, *Planning, *Computers, *Costs, Operations research, Pumping, Aquifers, Equations, Flow augmentation, Abstraction, River Severn(GB), Water demand, Simulation analysis, Water allocation(Policy).

The River Severn forms a vital part of the water supply of the West Midlands in the United Kingdom. Demand from this river is increasing and is estimated to exceed the present reliable yield by 225 Ml/d by the late 1980's. To cope with this shortfall, it is proposed to regulate flow by pumping groundwater from the Triassic sandstone of North Shropshire into the river. An integral part of the resource study of this aquifer has been the development of a mathematical groundwater model. This paper describes how the model has contributed to the design of the scheme and its use in assessment of performance and operational management. It also describes the setting up of the

model, its data and computer requirements, cost of operation and benefits. It is shown that the cost of model development is small in relation to the overall cost of the scheme and that the benefits of the model will increase as the load factor on the groundwater increases. (See also W79-09285) (Bell-Graf--Cornell)
W79-09308

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

4C. Effects On Water Of Man's Non-Water Activities

INTERRELATING LAND AND WATER MANAGEMENT IN FLORIDA,
For primary bibliographic entry see Field 6E.
W79-09176

SIMULATION OF STORMWATER RUNOFF AND SEDIMENT YIELD FOR ASSESSING THE IMPACT OF SILVICULTURE PRACTICES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. M. Li, K. G. Eggert, and D. B. Simons.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 295-307, 1979. 6 fig, 11 ref.

Descriptors: *Watershed management, *Water yield, *Sediment yield, Forest management, Model studies, Simulation analysis, Storm runoff, *Forest practices.

During the past two decades several watershed modeling techniques have been developed to allow the prediction of water and sediment yield. The estimations of infiltration, runoff and sediment yield are the major process components required for simulating watershed response. These process models, when based on sound physical reasoning are generally recognized as an important predictive tool in assessing the impact of land use and silviculture management schemes on the environment. Unfortunately, these models are often necessarily complex in formulation and require considerable expertise and computer time to achieve reasonable results. Therefore, although quite accurate, their complexity often seems to inhibit their utility. In order to generate an answer quickly and with reasonable expenditure, easier techniques such as the basin recharge method, the unit hydrograph and the Universal Soil Loss Equation are often used despite their deficiencies. The simple watershed model presented in this paper combines the advantages of a nonlinear, physically based approach with the utility of an interactive format. (See also W79-09185) (Skogerboe-Colorado State)
W79-09206

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

4D. Watershed Protection

PHYSICAL MODEL OF THE HYDROLOGY OF SLOPING HETEROGENEOUS FIELDS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 2G.
W79-09161

THE ECONOMIC IMPLICATIONS OF EROSION AND SEDIMENTATION CONTROL PLANS FOR SELECTED PENNSYLVANIA DAIRY FARMS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W79-09210

FARM-LEVEL ECONOMIC EVALUATION OF EROSION CONTROL AND REDUCED CHEMICAL USE IN IOWA,
Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 3F.
W79-09211

ECONOMIC IMPACTS OF POLICIES TO CONTROL EROSION AND SEDIMENTATION IN ILLINOIS AND OTHER CORN-BELT STATES,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
W. D. Seitz, C. Osteen, and M. C. Nelson.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 373-382, 1979. 10 ref.

Descriptors: *Erosion control, *Sediment control, Soil erosion, Economic impact, Agricultural watersheds, Linear programming, Water pollution control, Water quality control, Corn belt, Nonpoint sources.

This paper addressed (1) the costs to society of controlling agricultural nonpoint sources of pollution, specifically erosion and sedimentation, and (2) the variation in economic impacts as states or/and areas enact varying levels of control. A large linear programming model of the corn-belt region which accounts for variable corn and soybean production and prices was used in the analysis. This model was used to evaluate alternative erosion control policies implemented in selected areas of the corn belt. At the corn belt level, impacts on social cost, farm income, food costs, commodity prices and production, land use, and soil loss were discussed. The analysis of varying controls by areas was measured in terms of impacts on the comparative advantage, farm income, crop production, land use and soil loss of controls applied in Illinois and Wisconsin. The paper also reported the results of an analysis of the long-run impacts of soil erosion and soil erosion control policies on farm income. This analysis was conducted on a representative watershed using a series of linear programming models with adjustments to reflect the impacts of erosion on productivity. (See also W79-09185) (Skogerboe-Colorado State)
W79-09212

PROCEDURE FOR ECONOMIC EVALUATION OF BEST MANAGEMENT PRACTICES,
Soil Conservation Service, Washington, DC.
T. H. Dempster, and J. H. Stierna.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 383-391, 1979. 1 fig, 1 tab, 3 ref.

Descriptors: *Soil conservation, *Soil erosion, Management, Economic impact, Environmental effects, Water pollution control, Water quality control, Farm practices.

Evaluation procedures for best management practices (BMP) were discussed with emphasis on alternative practices affecting water conservation and quality, and production efficiency. Onsite and offsite resource problems that were identified and measured, include those related to reduced agricultural production and increased production and maintenance costs per unit of output which can result from erosion, sedimentation, impaired water quality and reduced soil moisture. Quantified data from the use of universal soil loss equation, research studies of extension, universities and Agricultural Research Services (ARS), and compiling of experienced crop yields were evaluated with computerized methods such as the Crop Budget System (CBS), linear programming and value of agricultural production. CBS is a system designed for efficient storage, rapid retrieval, use and revision of crop budgets used to evaluate alternative systems of BMP. Qualifying statements on nonmonetary impacts, primarily environmental issues, were also discussed. Procedures describing the estimation of installation, operation and maintenance costs of BMP were included, as well as methods to assess income foregone and adverse environmental effects. (See also W79-09185) (Skogerboe-Colorado State)
W79-09213

AN ECONOMIC ANALYSIS OF EROSION CONTROL OPTIONS IN TEXAS,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
D. R. Reneau, and C. R. Taylor.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 393-418, 1979. 4 fig, 8 tab, 11 ref.

Descriptors: *Erosion control, Soil erosion, Economic impact, *Sediment control, Water pollution control, Water quality control, Model studies, *Texas, Nonpoint sources, Farm practices.

A model for estimating the changes in farming practices, farm income, soil loss, offsite sediment damages, and social welfare over a long planning horizon for a watershed under various nonpoint source control options was presented. The model was sufficiently general to permit the study of several possible nonpoint source control options, including: (a) per acre soil loss limits; (b) soil loss taxes; (c) conservation practice cost sharing arrangements; and (d) combinations thereof. On-farm economics of conservation was imbedded in the model. Results from this modeling approach for Lavon Reservoir Watershed were presented. Included were the estimated changes in farming practices, farm income, soil loss, and off-site sediment damages for the selected nonpoint source control options. (See also W79-09185) (Skogerboe-Colorado State)
W79-09214

ECONOMIC, INSTITUTIONAL AND WATER QUALITY CONSIDERATIONS IN THE ANALYSIS OF SEDIMENT CONTROL ALTERNATIVES: A CASE STUDY,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
B. M. H. Sharp, and S. J. Berkowitz.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 429-453, 1979. 6 fig, 8 tab, 20 ref.

Descriptors: *Sediment control, Economic impact, *Institutional constraints, Linear programming, Soil conservation, Sediment yield, Sediment load, Model studies, Decision making.

Traditional economic analyses of the impact of conservation policies on the farm firm have relied solely upon the establishment of soil loss constraints to induce compliance. There are, however, different approaches to inducing a pattern of behavior which are also consistent with achieving the desired reduction in sediment. These policy options also have differing economic, institutional and water quality implications. The results of a study, conducted in a 440 acre watershed in Washington County. Wisconsin, which explicitly recognizes a set of institutional alternatives designed to modify operator behavior, were presented. In addition, the water quality implications of these alternatives with respect to sediment loads were illustrated. (See also W79-09185) (Skogerboe-Colorado State)
W79-09216

DEVELOPMENT OF BMPS FOR AGRICULTURE-NEW YORK STATE STRATEGY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W79-09224

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TOXICITY OF PULP AND PAPER MILL EFFLUENT: A LITERATURE REVIEW,
Corvallis Environmental Research Lab., OR.
F. F. Hutchins.
U. S. Environmental Protection Agency, EPA-600/3-79-013, February, 1979. 7 tab, 146 ref.

Descriptors: *Pulp wastes, *Pulp and paper industry, Toxicity, Bioassay, Laboratory tests, Industrial wastes, *Water pollution effects, Freshwater fish, Physiological effects, Marine fish, Waste treatment, Sulfite pulping wastes, Kraft pulping wastes, Groundwood pulp, Sublethal effects, *Resin acids, Environmental effects, Toxic compounds.

Untreated pulp and paper mill effluents are very toxic to most aquatic life. Concentrations as low as two percent can be acutely toxic to fish. Sufficient treatment can render the effluent nontoxic much of the time; however, treatment processes used by most mills reduce toxicity but do not eliminate it. Even effluents receiving 'good' treatment may exhibit sporadic and dynamic increases in toxicity (due in part to spills or dumping of spent pulping chemicals). Sublethal exposures to aquatic organisms to pulp effluent may affect a number of their physiological and behavioral functions. The principal toxic components in pulp and paper mill effluents are resin acids and fatty acids naturally occurring in the wood pulp and, in effluents from bleaching processes, toxic chlorinated compounds predominate. Untreated effluents have caused considerable environmental damage, but well-treated effluents have had minimal effects on fish production, although shifts in biological diversity have occurred. (Katz-EIS)
W79-09097

THE EFFECT OF MERCURIC CHLORIDE ON SOME BIOCHEMICAL INDICATORS OF THE BRAIN, BLOOD AND LIVER OF THE 'CASPIAN ROACH', RUTILUS RUTILUS CASPICUS,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Makhachkala (USSR). Dagestanskii Div.
For primary bibliographic entry see Field 5C.
W79-09099

ARSENIC AND OTHER TRACE ELEMENTS IN THE WATERS AND ORGANISMS OF AN ESTUARY IN SW ENGLAND,
Westfield Coll., London (England).
D. W. Klumpp, and P. J. Peterson.
Environmental Pollution, Vol. 19, p 11-20, 1979. 2 fig, 6 tab, 27 ref.

Descriptors: *Arsenic, *Trace elements, *Estuaries, *Path of pollutants, *Bioaccumulation, *Water quality, *Benthos, Zinc, Copper, Cadmium, Metals, Estuarine environment, Intertidal areas, Carnon River(England), Ostrea, Oysters, Shellfish, Public health, Mussels, Aquatic plants, Fucus.

Arsenic, cadmium, copper and zinc occur at elevated levels in the waters of Carnon River and the upper reaches of Restronguet Creek, these concentrations decreasing progressively towards the estuary of Carrick Roads. While arsenite is the main form of As in the Carnon River, this is converted to arsenate in the lower estuary. Organisms analysed from Restronguet Creek reflect the As concentration in the water, this being most clearly evident in macrophytes. Although accumulated at all trophic levels, there was no evidence for biomagnification of As on an entire organism basis. The As was shown to exist in selected organisms as a compound(s) which forms on hydrolysis, dimethylarsinate and traces of arsenate and methylarsonate. (Katz-EIS)
W79-09103

METAL ACCUMULATION BY AQUATIC BRYOPHYTES FROM POLLUTED MINE STREAMS,
Westfield Coll., London (England).
M. A. S. Burton, and P. J. Peterson.
Environmental Pollution, Vol. 19, p 39-46, 1979. 1 fig, 6 tab, 18 ref.

Descriptors: *Lead, *Zinc, *Mine wastes, *Path of pollutants, *Aquatic bryophytes, *Bioaccumulation, Mining industrial wastes, Water pollution sources, Water pollution, Aquatic plants, Streams, Liverworts, Monitoring, Zinc ions, Wales.

Analytical data are presented for metal concentrations in aquatic bryophytes growing in the streams of a lead-zinc mining area in Dyfed, Wales. The highest concentrations of zinc (7023 ppm/dry weight) and of lead (16,000 ppm/dry weight) were recorded in plants growing nearest the mines, reflecting the extent of metal pollution in the water. The widespread occurrence of some species in these areas suggests a wide range of tolerance. The chemical form of zinc in stream water from the Frongoch mine, in which the zinc concentration was 58 ppm, was demonstrated to be Zn(++). (Katz-EIS)
W79-09104

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,
Provinciale Waterstaat van Gelderland Arnheim (Netherlands).
B. de Boer.
Hydrological Sciences - Bulletin des Sciences, Hydrologiques Vol. 24, p 199-211, 1979. 8 fig, 14 ref.

Descriptors: *Model studies, *Phytoplankton, *Biochemical oxygen demand, *Sewage effluents, *Sewage treatment, *Dissolved oxygen, Methodology, Mathematical models, Pollution abatement, Forecasting, Rivers, Aquatic environment, Water pollution effects, Water pollution sources, Oxygen, Water quality control, Streams, Water management(Applied), Agricultural runoff.

The model presented has the purpose of predicting the effects of water resources management measures like sewage treatment, land fertilizer reduction and water level control on the oxygen and phytoplankton dynamics in a stream. A dynamic, one-dimensional model of the behaviour of BOD, a plant nutrient, phytoplankton and oxygen is given. The processes described are local discharges like the effluent from sewage treatment plants, distributed discharges, extractions, advection, dispersion, photosynthesis and respiration by phytoplankton, respiration of bacteria (BOD-decay), use and return of nutrients, distributed reaeration and reaeration at weirs. A method of characteristics (nodes moving with the stream velocity) is chosen to prevent numerical dispersion in a flexible way, i.e. the dispersion coefficient and the stream velocity may vary with place and time, and are limited by the place and time step values acceptable, like the other inputs. Thus, realistic modelling is possible without the large computing times required by steady grid methods if the dispersion is low. This situation occurs frequently in the Netherlands. (D. Katz-EIS)
W79-09108

INFLUENCE OF STOCK DENSITY AND FOOD USED ON GROWTH OF CARP KEPT IN COOLING WATERS,
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
R. Trzebiatowski, J. Filipiak, and R. Jakubowski.
Acta Ichthyologica et Piscatoria, Vol. 8, No. 1, p 43-53, 1978. 5 fig, 4 tab, 6 ref.

Descriptors: *Aquiculture, *Cooling water, *Fish diets, *Carp, *Fish populations, *Aquatic productivity, *Growth rates, Fish farming, Fish management, Fish stocking, Density, Productivity, Population, Freshwater fish, Size, Nutrients, Dolna Odra Power Station.

The results of studies on the influence of various stock densities and foods differing in their chemical composition on the growth of fishes kept in cages placed in the Dolna Odra power station cooling waters. Optimal stock densities for cage-rearing carp (C2-3) in cooling waters range within 100-140 ind. per cubic meter. Granule diameter of the granulated food should be gradually increased with fish growth, which is one of the prerequisites for an economical utilisation of fish food. In an intensive rearing of carp in cooling waters, it is possible to use foods of about 20 percent protein content. This indicates a possibility of manufacturing much cheaper foods and of utilizing their protein content in a much more economical way. (D. Katz-EIS)
W79-09109

EFFECT OF WATER TEMPERATURE ON THE INFECTION OF RAINBOW TROUT SALMO GAIRDNERI RICHARDSON WITH INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS,
Oregon State Univ., Corvallis. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W79-09111

THE EFFECT OF PH ON OXYGEN CONSUMPTION AND ACTIVITY IN THE BATHYPELAGIC MYSID GNATHOPHAUSIAINGENS,
California Univ., Santa Barbara. Dept. of Biological Sciences.
T. J. Mickel, and J. J. Childress.
Biological Bulletin, Vol. 154, p 138-147, 1978. 4 fig, 1 tab, 20 ref.

Descriptors: *Hydrogen ion concentration, *Oxygen, Dissolved oxygen, *Zooplankton, Animal physiology, *Respiration, Oxygen demand, Oxygen requirements, Crustaceans, Mysids, Bioassay, Methodology, Laboratory tests, Oxygen consumption, Animal behavior.

Pleopod beat of Gnathophausia ingens was unaffected by pH at pH 7.1 and pH 7.9 but was lower at pH 8.7 due to increased cleaning activity. The relationship between oxygen consumption rate and activity was unaffected by pH in the range of pH 7.1 and pH 8.7. The percent O2 extraction of oxygen by G. ingens was not statistically different at pH 7.9 and pH 8.7, but was greater at pH 7.1. The ability of G. ingens to regulate its oxygen consumption was unaffected by pH in the range studied. Since the increase in percent O2 extraction at pH 7.1 does not improve the ability of G. ingens to regulate its oxygen uptake, it appears that there is a loss in effectiveness elsewhere in its respiratory system at this pH. (Deal-EIS)
W79-09112

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE THIRD U.S.-JAPAN EXPERTS' MEETING--NOVEMBER 1977--EASTON, MARYLAND,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 777, Price codes: A14 in paper copy, A01 in microfiche.
U. S. Environmental Protection Agency, Report No. EPA-600/3/78-084, 312 p, 1978. Peterson, S. A. and Randolph, K. K., Editors.

Descriptors: *Bottom sediments, *Water quality control, *Bioaccumulation, Sediments, Metals, Heavy metals, Polychlorinated biphenyls, Chemical wastes, Industrial wastes, Dredging, Turbidity, Eutrophication, Bioassay, Benthic fauna, Water quality standards, Chemical analysis, Pesticides.

The United States-Japan Ministerial Agreement of May 1974 provided for the exchange of environmental information in several areas of mutual concern. This report is the compilation of papers presented at the Third U.S.-Japan Experts' Meeting

on the Management of Bottom Sediments Containing Toxic Substances, one of the 10 identified problem areas. The first meeting was held in Corvallis, Oregon, in November 1975. The second meeting was hosted by the Japanese Government in October 1976. The third meeting (at which these papers were presented) was held in November 1977 in Easton, Maryland. (See W79-09114 thru W79-09130) (Deal-EIS)
W79-09113

TURBIDITY GENERATED BY DREDGING PROJECTS,
Ministry of Transport, Kobe (Japan). Bureau of Ports and Harbors.
O. Nakai.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 31-47, 1978. 12 fig, 5 tab, 2 app, 2 ref.

Descriptors: *Dredging, *Turbidity, *Mathematical models, *Japan, Channel improvement, Bottom sediments, Soils, Soil types, Phytoplankton, Photosynthesis, Fish behavior, Fish physiology, Particle size, Turbidity currents, Tides.

This paper discusses investigations into turbidity generated by dredging during port construction. The study was made by the Bureau of Ports and Harbors and the Port and Harbor Research Institute, Ministry of Transport from 1973 to 1976. Field investigations were conducted to develop a method for predicting the quantity of turbidity generated by various dredges in different kinds of soil. A turbidity generation unit (TGU) was calculated using the results of these field investigations. It is defined as the quantity of turbidity generated per unit volume of dredged material, and can be effectively used to predict the quantity of turbidity. (See also W79-09113) (Deal-EIS)
W79-09116

RECENT PROGRESS IN TECHNIQUES FOR MANAGING CONTAMINATED BOTTOM SEDIMENTS,
Japan Dredging and Reclamation Engineering Association, Tokyo.
H. Koba.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 49-64, 1978. 21 tab, 1 ref.

Descriptors: *Bottom sediments, *Management, *Water quality control, *Japan, Water quality standards, Regulation, Law enforcement, Chemical wastes, Industrial wastes, Mine wastes, Oil, Mercury, Polychlorinated biphenyls, Water chemistry, Waste treatment, Suspended solids, Dredging, Waste disposal.

In Japan many ports, rivers, lakes and marshes possess contaminated bottom sediments which create undesirable effects on the surrounding environment. The pollutants in these bottom sediments are traced to waste from manufacturing plants or mine tailings, urban sewage, agricultural effluents and other industrial or urban sources. The most effective solution to the problem is to control pollution at the original source, but this is usually very difficult or impractical. Therefore, the management of contaminated bottom sediments has to be implemented in conjunction with countermeasures taken directly at the sources. This paper provides a brief introduction to recent progress on management techniques for contaminated bottom sediments. (See also W79-09113) (Deal-EIS)
W79-09117

DREDGING TOXIC SEDIMENTS IN YOKKAICHI PORT,
Yokkaichi Port Authority (Japan).
H. Ito.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 65-85, 1978. 7 fig, 1 tab.

Descriptors: *Dredging, *Bottom sediments, *Chemical wastes, *Japan, Industrial wastes, Sewage disposal, Waste disposal, Water quality control, Regulation, Water chemistry, Turbidity, Water pollution sources.

An outline of Japanese dredging projects to remove contaminated sediments was presented at the Second Conference held in Tokyo in October, 1976. This paper is a followup to report on the actual dredging work taking place in Yokkaichi Port. It is important to carefully investigate the area to be dredged. When this project began we found that vinyl, tires, steel wires, and other trash would clog the dredge pipe and this unexpectedly lowered the dredging capacity and prolonged the work. Sometimes the measured values of the biological indices at the monitoring points exceed the standards, but not due to reasons caused by dredging. If this is the case it is not necessary to slow down or halt the work. The problem is to determine quickly and easily the cause of the high values. Usual causes are the red tide and organically-rich river water flowing into the areas. These may be effectively judged by visual means except where turbidity is high. Then only the surface is visible and a transmissometer may be used to establish the turbidity, particularly around the dredging site, after which the dredging effect may be accounted for and the excess attributed to the other causes. (See also W79-09113) (Deal-EIS)
W79-09118

ACCUMULATION OF METHYL MERCURY IN RED SEA BREAM (CHRYSOPHRYS MAJOR) VIA THE FOOD CHAIN,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
M. Fujiki.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 87-94, 1978. 4 tab.

Descriptors: *Mercury, *Food chains, *Bioaccumulation, *Tissue analysis, *Bream, *Chrysophrys, Chemical analysis, Diatoms, Copepods, Juvenile growth stage, Absorption, Fish, Physiology, Path of pollutants, Water chemistry, Bioassay.

Accumulation of methyl mercury in red sea bream (Chrysophrys major) results from food chain accumulations--from diatoms to copepoda to the juvenile bream. Diatoms were reared for 24 hours in filtered sea water containing 5.0 ppb methyl mercury. Methyl mercury taken up by the diatoms reached a concentration of 3.45 ppm. The diatoms containing methyl mercury were then fed to the copepoda for 4 days. The concentration of methyl mercury in the copepoda reached 3.14 ppm. The copepoda were then fed to the juvenile red sea bream for 10 days. Methyl mercury concentration in the fish reached 3.10 ppm. The concentration of methyl mercury in the diatoms and the copepoda was about 2,000 times as much as that of the culture solution. The increase of methyl mercury from food to fish was about one. However, the amount of methyl mercury taken up by the juvenile bream was about 120 times as much as that of the control. (See also W79-09113) (Deal-EIS)
W79-09119

AN OVERVIEW OF BOTTOM SEDIMENT PROBLEMS IN SAGINAW RIVER AND BAY, MARINETTE-MENOMINEE HARBOR, AND WAUKEGAN HARBOR,
Environmental Protection Agency, Chicago, IL. Region V.
K. E. Bremer.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 199-212, 1978. 2 fig, 5 tab, 3 ref.

Descriptors: *Bottom sediments, *Great Lakes, *Dredging, *Arsenic, *Tissue analysis, Polychlorinated biphenyls, Path of pollutants, Channel improvement, Lake Huron, Fish populations, Benthic fauna, Lake Michigan, Sediments, Waste disposal, Marinette-Menominee.

Three waterways in the Great Lakes were selected for an overview of their current toxicant problems in bottom sediments. The Marinette-Menominee Harbor has severe arsenic problems associated with leaching from an adjacent waste storage area. Polychlorinated biphenyl contamination of bottom sediments is common to both Saginaw River and Bay and Waukegan Harbor. Problems related to fish contamination, proper dredging techniques and disposal of bottom sediments are discussed. (See also W79-09113) (Deal-EIS)
W79-09125

IMPACTS ASSOCIATED WITH THE DISCHARGE OF DREDGED MATERIAL INTO OPEN WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
R. M. Engler.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 213-223, 1978. 25 ref.

Descriptors: *Dredging, *Waste disposal, Nutrients, Metals, Organic compounds, Absorption, Aquatic populations, Benthic fauna, Mathematical models, Spoil banks, Chemical analysis, Heavy metals, Chlorinated hydrocarbon pesticides.

With few exceptions, impacts of aquatic disposal are mainly associated with the physical effects. These possible effects are persistent, often irreversible, and compounding. Geochemically, releases are limited to nutrients with negligible release of toxic metals and hydrocarbons. Biochemical interactions are infrequent with no clear trends and elevated uptake of toxic metals and hydrocarbons are negligible to nonexistant. (See also W79-09113) (Deal-EIS)
W79-09126

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO THE MARINE MACROBENTHOS,
Corvallis Environmental Research Lab., OR.
R. C. Swartz, W. A. DeBen, and F. A. Cole.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 225-237, 1978. 1 fig, 4 tab, 9 ref.

Descriptors: *Bioassay, *Benthic fauna, *Bottom sediments, *Toxicity, *Polychaetes, Sediments, Amphipoda, Mollusks, Aquatic populations, Particle size, Suspended solids, Chemical analysis, Duwamish River, Washington, Houston ship canal, Texas, Bailey Creek, Virginia, Raritan River, New Jersey, Coos Bay, Oregon.

A bioassay has been developed to determine the acute toxicity of the settleable phase of dredged material to the marine benthos. Five benthic invertebrates representing different taxonomic and trophic positions were allowed to acclimate to control (non-polluted) sediment and were then covered by a layer of either test or control sediment. Mean survival after ten days of exposure was significantly different from the controls for sediment from the Duwamish River, WA; Houston Ship Channel, TX; Bailey Creek, VA; and Raritan River, NJ; but there was no significant difference for sediment from Coos Bay and the Skipanon River, OR. There were substantial differences in survival among the five test species. The most sensitive species was the infaunal amphipod, Paraphoxus epistomus. (See also W79-09113) (Deal-EIS)
W79-09127

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME VI, APPENDIX 7, WATER QUALITY.
Corps of Engineers, Baltimore, MD. Baltimore District.
Report No. FCR-77-006, December 1977. 250 p, 25

fig, 49 tab, 45 ref, 2 append.

Descriptors: *Chesapeake Bay, *Water quality, *Forecasting, On-site investigations, Surveys, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Rivers, Flow, Industrial wastes, Runoff, Urban runoff, Temperature, Dissolved oxygen, Hydrogen ion concentration, Coliforms, Sewage, Bays, Estuaries.

The Chesapeake Bay Study developed through the need for a complete and comprehensive investigation of the use and control of the water resources of the Bay Area. In the first phase of the study, the existing physical, biological, economic, social, and environmental conditions and problem areas were identified and presented in the Existing Conditions Report. The Future Conditions Report, of which this appendix is a part, presented the findings of the second or projections phase of the study. Included as a part of this second phase were: projections of future water resource needs and problem areas, general means that might best be used to satisfy those needs, and recommendations for future studies and hydraulic model testing. Consequently, this report constitutes the next step toward the goal of developing a comprehensive water resource management program for Chesapeake Bay. This volume focused on the quality of the Bay's water resource and the impacts other resources uses have had and will continue to make upon it. This appendix provided an assessment of existing conditions, identified water quality problem areas, and cited the federal and state agencies currently responsible for management of the Bay's water quality conditions. Based on projections of sewered populations and waste loadings developed by the various state agencies throughout the Bay Area, future needs and problem areas were then developed. Lastly, the means that might best be used to satisfy the projected water quality needs and recommendations for future water quality studies were identified. (Sims-ISWS)
W79-09146

ENVIRONMENTAL FATE OF SELECTED PHOSPHATE ESTERS,
Monsanto Co., St. Louis, MO.
For primary bibliographic entry see Field 5B.
W79-09162

RAPID SPECTROSCOPIC METHODS FOR TRACE ELEMENT INVESTIGATIONS IN NATURAL WATERS,
New South Wales Univ., Kensington (Australia). Dept. of Analytical Chemistry.
L. E. Smythe, and R. J. Finlayson.
Australian Water Resources Council, Technical Paper No. 32, 1978. 31 p, 1 fig, 14 tab, 23 ref.

Descriptors: *Trace elements, *Chemical analysis, *Spectroscopy, *Water quality, Chemicals, Analytical techniques, Chemistry, Pollutants, Water pollution, Pollutant identification, Heavy metals, Equipment, Instrumentation, Methodology.

The potential of some inherently rapid atomic spectroscopy-based systems for the chemical analysis of heavy metals in water has been assessed. The study included suitable pre-analysis metal concentration schemes, the use of arc and spark emission spectroscopy in the multi-element mode, and graphite furnace atomization and flame atomic absorption in the single element mode. In the latter part of the study, there was also a limited evaluation of inductively coupled plasma atomic emission spectroscopy. The design and evaluation of suitable concentration schemes (concentration factor approximately x20,000) were shown to improve the performance of emission spectroscopy for the chemical analysis of natural waters. Further development of such schemes would also be useful in speciation studies. Of the concentration schemes studied, promising results were obtained using activated charcoal. Other schemes studied suffered somewhat from the introduction of metallic impurities, even in purified reagents, resulting in high blank values. Inductively coupled plasma atomic emission spectroscopy was also shown to have good potential for the direct multi-element analysis of waters at the 1-10 micrograms/liter level. (Sims-ISWS)
W79-09165

THE IMPACT OF URBANIZATION ON THE DISTRIBUTION OF HEAVY METALS IN BOTTOM SEDIMENTS OF THE SADDLE RIVER,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Environmental Sciences.
W. G. Wilber, and J. V. Hunter.
Water Resources Bulletin, Vol. 15, No. 3, p 790-800, June 1979. 3 fig, 5 tab, 13 ref. OWRT A0505-N.J.(3), 14-34-0001-8032.

Descriptors: *Heavy metals, *Sediments, *Urbanization, *New Jersey, Particle size, Sediment transport, Chemical oxygen demand, Distribution patterns, Spatial distribution, Metals, Lead, Zinc, Copper, Nickel, Chromium, Cadmium, Iron, Manganese, Rivers, Pollutants, Water pollution, *Saddle River(NJ), *Lodi(NJ).

A three-year study has been conducted on a 4.6 mile stretch of the Saddle River near Lodi, New Jersey. The primary objectives of this investigation were (1) to provide baseline information on the concentration and distribution of heavy metals in bottom sediments of the Saddle River; (2) to qualitatively evaluate which parameters affect this distribution; and (3) to determine the effect of urbanization on the concentration and distribution of these materials. Significant enrichments of several heavy metals were observed in bottom sediments of the lower Saddle River near Lodi, New Jersey, as compared to the upper Saddle River. Attempts to correlate metal concentrations in bottom sediments with chemical-oxygen demand were not successful in demonstrating a relationship between these two factors. Metal concentrations were found to be strongly dependent upon particle size. In general, metal concentrations in bottom sediments increased with decreasing particle diameter. However, metals enrichment was observed to be considerably greater in the larger sediment fractions studied (greater than 420 microns) than the smaller sediment fractions as one proceeded downstream through the urban area. Since the larger sediment fractions are least affected by scour and transport, they may best reflect the effect of urbanization on the distribution of heavy metals over an extended period of time at a given location. (Sims-ISWS)
W79-09233

5B. Sources Of Pollution

OIL SPILLS IN A RIVER: A ONE-DIMENSIONAL MODEL,
Institut Prikladnoi Geofiziki, Moscow (USSR).
G. Th. Voznesensky.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 213-223, June 1979. 8 fig, 7 ref.

Descriptors: *Oil spills, *Rivers, *Model studies, Mathematical models, Flow, River flow, Dispersion, Open channels, Ice, Ice cover, Oil pollution, Water pollution, Distribution patterns, Spatial distribution, Pollutants, Path of pollutants.

A linear, one-dimensional model was proposed to describe the river pollution resulting from oil spills. Two interacting migratory forms, water surface pollution and water body pollution, were considered. In the coordinate system moving with the mean flow velocity, the equations for the pollutant distributions were reduced to the type of a heat conduction equation with distributed unsteady sources. The solutions for oil concentrations, obtained in the form of the 'heat potential' were considered in two particular cases: (1) an oil spill in an open channel; and (2) river pollution from drifting ice due to the melting of polluted ice. (Sims-ISWS)
W79-09096

CASES OF MASS MORTALITY OF THE WALLEYE POLLOCK, THERAGRA CHALCOGRAMMA, IN THE SEA OF OKHOTSK,
Pacific Research Inst. for Fisheries and Oceanography, Magadan (USSR). Magadan Dept.
V. A. Vyshegorodtsev.
Journal of Ichthyology, Vol. 18, No. 1, p 146-147, 1978.

Descriptors: *Fish kill, *Mortality, *Fish disease, *Water temperature, Commercial fish, On-site-investigations, Parasitism, Pacific Ocean, Sea of Okhotsk, Kamchatka, *Walleye pollock, Mass mortality, Fish populations.

Mass mortalities of walleye pollock were observed in the spring of 1974 in the Northwestern part of the Sea of Okhotsk. The number of dead fish was no less than 2,780,000. Other mass mortalities of the same fish have been reported in March 1941 and 1958 off the Southwest Coast of Kamchatka. It is believed that epizootic disease in combination with the thermal regime in the area of fish concentration is the direct cause of the mass mortalities. (Katz-EIS)
W79-09098

TCDD IN THE ENVIRONMENT,
Power Authority of the State of New York.
For primary bibliographic entry see Field 5C.
W79-09101

CHLORINE IN THE MARINE ENVIRONMENT,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 5C.
W79-09102

ARSENIC AND OTHER TRACE ELEMENTS IN THE WATERS AND ORGANISMS OF AN ESTUARY IN SW ENGLAND,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5A.
W79-09103

METAL ACCUMULATION BY AQUATIC BRYOPHYTES FROM POLLUTED MINE STREAMS,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5A.
W79-09104

SEASONAL LEVELS OF CHLORINATED HYDROCARBONS AND HEAVY METALS IN FISH AND BROWN SHRIMPS FROM THE MEDWAY ESTUARY, KENT,
City of London Polytechnic (England). Dept. of Biological Sciences.
W. L. F. van den Broek.
Environmental Pollution, Vol. 19, p 21-38, 1979. 1 fig, 4 tab, 33 ref.

Descriptors: *Whiting, *Flounder, *Eels, *Polychlorinated biphenyls, *Path of pollutants, *Chlorinated hydrocarbon pesticides, *Mercury, *Cadmium, *Pesticide residues, Estuaries, Estuarine environment, Copper, Lead, Zinc, Heavy metals, Metals, Pesticides, Public health, Seasonal, Brown shrimp, Baseline studies, Medway Estuary(Great Britain), Industrial wastes, Agricultural runoff.

Selected fish, including eel, whiting, flounder, plaice, and some of their dietary constituents were screened for organochlorine pesticides (dieldrin, DDE, DDT, TDE), polychlorinated biphenyls and mercury, cadmium, copper, lead and zinc. Metal concentrations were low and indicated little more than background levels. Chlorinated hydrocarbons, on the other hand, tended toward the maximum part of the range of values quoted in the literature. They exhibited no marked seasonal variations which may have been connected with agricultural activities but their concentrations were correlated with the lipid content of most tissues. (Katz-EIS)
W79-09105

BIOACCUMULATION OF AROCLOR 1016 IN HUDSON RIVER FISH,
New York State Dept. of Environmental Conservation, Rome.
J. C. Skea, H. A. Simonin, H. J. Dean, J. R.

Colquhoun, and J. J. Spagnoli.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 332-336, 1979. 1 tab, 7 ref.

Descriptors: *Polychlorinated biphenyls, *Fish physiology, *Hudson River, *Aroclors, *Bioaccumulation, *Tissue analysis, Perches, Bullheads, Sunfishes, Path of pollutants, Chemical analysis, Water chemistry, Gas chromatography, On-site-investigations.

Brown bullheads (Ictalurus nebulosus), yellow perch (Perca flavescens), pumpkinseeds (Lepomis gibbosus) and creek chubsuckers (Erimyzon oblongus) were captured in a relatively uncontaminated lake and transferred to three cages in the Hudson River (New York). One cage was placed downstream from a suspected source of the PCB Aroclor 1016 while the other two were located upstream to serve as controls. After 14 days the fish were sacrificed and analyzed for PCB content. Analysis of fish from upstream cages and fish frozen for background levels showed residues of less than 0.02 micrograms/g Aroclor 1016 (lowest detectable level). Fish taken from the cage at the PCB site had Aroclor 1016 levels which varied from 1.8 micrograms/g in yellow perch to 3.8 micrograms/g in a composite of brown bullheads. The chromatograms of the fish residues were identical to those of Aroclor 1016. Using a mean fish concentration of 2.6 micrograms/g (range 1.8 ug/g - 3.8 ug/g) these fish in 14 days bioaccumulated Aroclor 1016 at 15,000 times the water concentration (0.17 micrograms/l). If we use 0.10 micrograms/l as the water concentration the 14 day bioaccumulation factor is 26,000. (Deal-EIS)
W79-09106

IN VIVO RESPONSE OF ATPASES IN FEW TISSUES OF THE FISH MYSTUS VITTATUS (HAM.) TO THE SYNTHETIC DETERGENT SWACOFIX (R) E45 (ABS),
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, D. Mohan, A. K. Tyagi, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 327-331, 1979. 2 tab, 12 ref.

Descriptors: *Enzymes, *Toxicity, *Detergents, *Tissue analysis, *Mystus, Fish physiology, Animal metabolism, Sulfonates, Chemical wastes, Biochemistry, Inhibition, Mode of action, Chemical analysis, Chemical properties, Swacofix, Bioassay.

The response of the ATPase system in brain, gill, liver and kidney from Mystus vittatus to chronic exposure to different sublethal concentrations of Swascofix (R) E45 was determined in vivo. The inhibition patterns of all ATPases assayed at all concentrations was quite similar in all four tissue types and was concentration dependent. The highest inhibition was noted in brain, followed by gill, kidney and liver, respectively. (Deal-EIS)
W79-09107

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,
Provinciale Waterstaat van Gelderland Arnheim (Netherlands).
For primary bibliographic entry see Field 5A.
W79-09108

EGG SHELL CHARACTERISTICS OF GANNETS SULA BASSANA, SHAGS PHALACROCORAX ARISTOTELIS AND GREAT BLACK-BACKED GULLS LARUS MARINUS EXPOSED TO DDE AND OTHER ENVIRONMENTAL POLLUTANTS,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
A. S. Cooke.
Environmental Pollution, Vol. 19, p 47-65, 1979. 7 tab, 8 fig, 43 ref.

Descriptors: *Bird eggs, *Water birds, *Gulls, *DDE, *Path of pollutants, *Polychlorinated biphenyls, *Dieldrin, Birds, Gannets, Black-backed gulls, Shag, Sula, Phalacrocorax, Larus, Pesticide residues, Shell thickness, Water pollution effects, Metabolism, Inhibitors.

Structure, strength and chemical composition of egg shells of gannets (Sula bassana), shags (Phalacrocorax aristotelis), and great black-backed gulls (Larus marinus) have been studied in relation to egg residues of DDE. For each species, eggs that were highly contaminated with DDE tended to have thin shells. For the gannet, shell thinning was mainly due to loss of the vaterite cover. For the shag, cover loss was again considerable, but the true shell was also significantly reduced in thickness. Gull shells do not have a cover, and for the great black-backed gull most of the shell thinning was due to a reduced palisade layer. The different types of structural defect observed in the shells of these and other species could result from a single biochemical lesion such as enzyme inhibition in shell gland tissue. As the thickness of the shell decreased, so shell strength for the gannet and shag did not decrease as markedly as for the gull and other species. Partial loss of cover had little effect on strength compared with loss of true shell. Had the cover been entirely missing, however, strength would have been seriously affected. (D. Katz-EIS)
W79-09110

RECENT PROGRESS IN TECHNIQUES FOR MANAGING CONTAMINATED BOTTOM SEDIMENTS,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5A.
W79-09117

ACCUMULATION OF METHYL MERCURY IN RED SEA BREAM (CHRYSOPHRYS MAJOR) VIA THE FOOD CHAIN,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
For primary bibliographic entry see Field 5A.
W79-09119

THE RELATIONSHIP BETWEEN SEDIMENTS AND BENTHOS IN MIKAWA BAY,
Japan Dredging and Reclamation Engineering Association, Tokyo.
T. Otsuki.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the third U.S.-Japan Experts' Meeting--November 1977, Easton Maryland. Report No. EPA-600/3-78-084, p 95-119, 1978. 6 fig, 8 tab, 5 ref.

Descriptors: *Bottom sediments, *Benthic fauna, *Mathematical studies, *Bays, *Japan, Sediments, Water quality, Biological communities, Sampling, Chemical analysis, Chemical oxygen demand, Sulfides, Humic acids, Dominant organisms, Distribution patterns, Mollusks, Crustaceans, Mikawa Bay.

In this study an attempt has been made to clarify the relationship between the sediments and the benthos in Mikawa Bay. The calculation of the Sediment Pollution Index (SPI) and its significance are presented. A correlation analysis is made between factors of sediment quality and SPI on one hand and factors such as predominant benthic species on the other. The results obtained in this study have indicated that, to a certain extent, there are correlations between some items of the first group and some items of the second group, e.g., correlations have been observed between SPI and species number with a linear regression formula of $y = -0.775x + 25.301$ ($r = -0.765$), and between SPI and percent crustacea with $y = -0.903x + 22.292$ ($r = -0.715$). (See also W79-09113) (Deal-EIS)
W79-09120

A HYDRODYNAMIC STUDY OF LAKE POLLUTION,
Japan Bottom Sediments Management Association, Tokyo.
T. Yoshida.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton Maryland. Report No. EPA-600/3-78-084, p 121-145, 1978. 13 fig, 4 tab.

Descriptors: *Mathematical models, *Lakes, *Lake sediments, *Japan, Heavy metals, Zinc, Copper, Iron, Manganese, Water chemistry, Water quality, Water analysis, Biochemical oxygen demand, Path of pollutants, Suspended solids, Chemical oxygen demand, Lake stages, Runoff, Methodology.

To understand pollution of lakes by solid materials it was necessary to understand the hydrodynamic behavior of the solid pollutants. To achieve this end theoretical equations were deduced. The first result derived from these equations was the concept of the dilution ability of a lake. This was illustrated with examples of three lakes. Next, the theoretical estimation of the deposited quantities of solid pollutants was described, and the relationships between the accumulated quantities of pollutants and common pollution indices for sediment was discussed. Finally, the hydrodynamic equations were applied to the distribution of toxic heavy metals in lake sediments. From the results it may be concluded that hydrodynamic analysis of lake pollution is a useful tool. (See also W79-09113) (Deal-EIS)
W79-09121

MITIGATION FEASIBILITY FOR THE KEPONE-CONTAMINATED JAMES RIVER, VIRGINIA,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
K. M. Mackenthun, M. W. Brossman, J. A. Kohler, and C. R. Terrell.
In: Management of Bottom Sediments Containing Toxic Substances; Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 153-181, 1978. 8 fig, 5 tab, 20 ref.

Descriptors: *Persistence, *Pesticide residues, *Rivers, *Kepone, *James River(Virginia), *Mitigation, Chesapeake Bay, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Hazards, Chemical wastes, Public health, Chemical analysis, Chemical properties, Human pathology, Pesticide toxicity, Sediments, Dredging.

As the result of carelessness in production and in waste disposal the health of Kepone production workers at Hopewell, Virginia, has been jeopardized and a 70-mile reach of the James River has been contaminated by this hazardous and persistent pesticide. In addition, Chesapeake Bay is threatened. EPA's Kepone Mitigation Feasibility Project was undertaken to address the threat posed by Kepone contamination and to recommend possible cleanup action. The project involves: (1) assessment of the biological and ecological impact of Kepone through literature search, laboratory and field studies; (2) assessment of the potential sources of continuing contamination by inflows into the James River; (3) sampling and evaluation of the contamination in the James River; (4) modeling the movement of contaminants; and (5) evaluation of potential conventional and nonconventional methods for mitigating the problem. Preliminary results indicate that continuing inflows of contamination into the James River exist, and that there is no evidence of any degradation in the pesticide or indication that natural causes will substantially alleviate the problem in the foreseeable future. While some mitigation methods now look promising, their cost-effectiveness must be evaluated. (See also W79-09113) (Deal-EIS)
W79-09123

HUDSON RIVER - PCB STUDY DESCRIPTION AND DETAILED WORK PLAN,
New York State Dept. of Environmental Conservation, Albany.
E. G. Horn, and L. J. Hetling.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 183-198, 1978. 5 fig, 3 tab, 13 ref.

Descriptors: *Polychlorinated biphenyls, *Hudson River, *Monitoring, *Bioaccumulation, Law en-

forcement, Water quality control, Water quality standards, Hazards, Path of pollutants, Chemical wastes, Industrial wastes, Absorption, Bottom sediments, Dredging, Water chemistry.

In 1976 the New York State Department of Environmental Conservation and the General Electric Company signed an agreement bringing to a close an action brought against General Electric relating to the discharge of PCBs into the Hudson River. Part of the settlement involved setting up programs for monitoring and reclamation of the river. The program includes monitoring of fish, macroinvertebrates, sediment, hydrology, wastewater treatment plant input, water and air. Extensive study of the data acquired will be used to determine the feasibility of reclamation. (See also W79-09113) (Deal-EIS)
W79-09124

IMPACTS ASSOCIATED WITH THE DISCHARGE OF DREDGED MATERIAL INTO OPEN WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5A.
W79-09126

EUTROPHICATION CONTROL: IMPORTANCE OF INTERNAL PHOSPHORUS SUPPLIES,
Corvallis Environmental Research Lab., OR.
D. P. Larsen, and D. W. Shults.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 239-261, 1978. 4 fig, 10 tab, 46 ref.

Descriptors: *Eutrophication, *Phosphorus, *Lakes, Nutrients, Chemical analysis, Sediments, Lake sediments, Bottom sediments, Sediment-water interfaces, Lake morphometry, Littoral, Turbidity, Aquatic populations.

Simple phosphorus mass balance models describing the relationship between supplies of phosphorus to lakes and resultant lake phosphorus concentrations demonstrate that internal supplies of phosphorus could be important in controlling lake concentrations. Recent investigations show that several areas within lakes could supply significant amounts of phosphorus over short periods of time. These include sediments overlain by anaerobic water, macrophyte communities, and littoral zone sediments especially when stirred by wind-induced turbulence. Chemical analysis of the phosphorus content of surficial sediments shows that the sediments act as a significant phosphorus reservoir, but not all the sediment phosphorus is in a form readily exchangeable with overlying waters. Examples describing the importance of internal phosphorus supplies show that the restoration of some lakes has been delayed by the feedback of phosphorus from the sediments at critical times during the year. (See also W79-09113) (Deal-EIS)
W79-09128

THE REGULATION GUIDELINES AND CRITERIA FOR THE DISCHARGE OF DREDGED MATERIAL: PREDICTION OF POLLUTION POTENTIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
R. M. Engler
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 263-272, 1978. 2 fig, 2 tab, 3 ref.

Descriptors: *Dredging, *Waste disposal, *Regulation, *Bioaccumulation, Water quality control, Water quality standards, Bioassay, Benthic fauna, Sediments, Bottom sediments, Water chemistry, Chemical analysis, Suspended solids, Aquatic populations.

Guidelines and criteria have been published for the ecological evaluations of the discharge of dredged and fill material into inland waters and the transportation of dredged material for dumping into ocean waters. Implementation manuals have subsequently been published and are discussed herein. Relevant dredged material research are also presented. These manuals present evaluative procedures for pollution evaluation. (See also W79-09113) (Deal-EIS)
W79-09129

EVALUATION OF THE CHLOROPHYLL CONCENTRATION TO PREDICT THE TROPHIC STATE OF LAKES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 225-228, June 1979. 9 ref.

Descriptors: *Chlorophyll, *Phosphorus, *Lakes, *Model studies, Mathematical models, Trophic level, Eutrophication, Nutrients, Phytoplankton, Forecasting, Water pollution, Limnology, Equations.

This paper presented a model for the relationship between the concentration of chlorophyll a and the total phosphorus concentration in a lake. From this model it is possible to predict the trophic state from the changing phosphorus content. (Sims-ISWS)
W79-09142

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME VI, APPENDIX 7, WATER QUALITY.
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 5A.
W79-09146

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,
Provinciale Waterstaat van Gelderland, Arnhem (Netherlands).
B. de Boer.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 199-211, June 1979. 8 fig, 14 ref.

Descriptors: *Dissolved oxygen, *Phytoplankton, *Rivers, *Model studies, Mathematical models, Biochemical oxygen demand, Aeration, Nutrients, Oxygen, Dispersion, Algae, Bacteria, Sewage, Sewage effluents, Pollutants, Path of pollutants, Water pollution, *The Netherlands.

The model presented has the purpose of predicting the effects of water resources management measures like sewage treatment, land fertilizer reduction, and water level control on the oxygen and phytoplankton dynamics in a stream. A dynamic, one-dimensional model of the behavior of BOD, a plant nutrient, phytoplankton, and oxygen was given. The processes described were local discharges like the effluent from sewage treatment plants, distributed discharges, extractions, advection, dispersion, photosynthesis and respiration by phytoplankton, respiration of bacteria (BOD-decay), use and return of nutrients, distributed reaeration and reaeration at weirs. A method of characteristics (nodes moving with the stream velocity) was chosen to prevent numerical dispersion in a flexible way, i.e., the dispersion coefficient and the stream velocity may vary with place and time, and are limited by the place and time step values acceptable, like the other inputs. Thus, realistic modelling is possible without the large computing times required by steady grid methods if the dispersion is low. This situation occurs frequently in The Netherlands. An application was shown. (Sims-ISWS)
W79-09157

ESTIMATION OF THE LONGITUDINAL DISPERSION AND SORPTION COEFFICIENTS IN SATURATED SOILS BY STRAIGHT-LINE METHODS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.).
L. Luckner, and H. Reissig.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 229-238, June 1979. 7 fig, 5 tab, 3 ref.

Descriptors: *Path of pollutants, *Dispersion, *Sorption, *Model studies, Mathematical models, Laboratory tests, Soil water, Soils, Soil water movement, Soil contamination, Solutes, Migration, Saturated flow, Water pollution, Soil science.

This paper described a graphical method for the estimation of the longitudinal dispersion and sorption coefficients K sub L and alpha of the unidirectional migration processes of pollutants in saturated homogenous soils. The migration process was regarded (comparable to the classical pumping test analysis) not only as a process in space with t = t sub i = constant, but also as a temporal process with x = x sub i = constant. This method was demonstrated by several laboratory experiments with Cl(-) and Ca(2+) ions regarded as pollutants. It was also shown that the migration process calculated with K sub L and alpha estimated by this method corresponds excellently with the measured data. (Sims-ISWS)
W79-09158

ENVIRONMENTAL FATE OF SELECTED PHOSPHATE ESTERS,
Monsanto Co., St. Louis, MO.
V. W. Saeger, O. Hicks, R. G. Kaley, P. R. Michael, and J. P. Mieure.
Environmental Science and Technology, Vol. 13, No. 7, p 840-844, July 1979. 5 fig, 5 tab, 16 ref.

Descriptors: *Pollutants, *Path of pollutants, *Phosphorus compounds, *Biodegradation, Sampling, On-site investigations, Laboratory tests, Chemicals, Chemical analysis, Water pollution, Rivers, Phosphorus, Phosphates, Carbon dioxide, Solubility, Sludge, Activated sludge, Esters, Phosphate esters.

Environmental fate studies encompassing water solubility, octanol/water partition coefficient, and biodegradability were carried out for 11 trialkyl, alkyl aryl, and triaryl phosphate esters. These studies concluded that phosphate esters as a group exhibit low aqueous solubility, have a moderate potential for bioconcentration, and readily undergo primary and ultimate biodegradation by naturally occurring mixed-microbial populations present in activated sludge and river water. (Sims-ISWS)
W79-09162

PROBLEM ASSESSMENT REPORT: SOIL EROSION SUBCOMMITTEE--ILLINOIS AGRICULTURAL TASK FORCE ON NON-POINT SOURCES OF POLLUTION.
Illinois Inst. of Natural Resources, Springfield.
For primary bibliographic entry see Field 2J.
W79-09164

LEGAL PROBLEMS OF STORMWATER POLLUTION ABATEMENT,
Spessard L. Holland Law Center, Gainesville, FL.
For primary bibliographic entry see Field 6E.
W79-09184

NONPOINT SOURCE POLLUTION CONTROL STRATEGY,
Environmental Protection Agency, Washington, DC. Water Planning Div.
W. S. Groszyk.
In: Best Management Practices for Agriculture and Silviculture, Proceedings, 1978 Cornell Agricultural Waste Management Conference, p 3-10, 1979.

Descriptors: *Water pollution control, Water quality control, Federal water pollution control act, Water quality act, Water law, Management, *Nonpoint sources, *Farm practices.

This paper discussed the two major elements of the U.S. Environmental Protection Agency's nonpoint source (NPS) pollution control strategy, and how two amendments in the Clean Water Act of 1977 provide additional ways to implement NPS control

programs, and thus solve some of the critical water quality problems. These two major elements of EPA's nonpoint source control program were: (1) to accelerate the implementation of NPS control programs and the application of Best Management Practices (BMP's) and, (2) to focus the available resources on solving the most severe problems first. (See also W79-09185) (Skogerboe-Colorado State)
W79-09186

A STATE PERSPECTIVE ON NONPOINT SOURCE MANAGEMENT,
New York State Dept. of Environmental Conservation, Albany.
P. A. A. Berle.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 17-24, 1979.

Descriptors: Water pollution control, Water quality control, Water quality act, Soil conservation, Water conservation, Water management(Applied), State governments, *New York, *Nonpoint sources, *Farm practices.

This paper projects the governmental perspective of the New York state on nonpoint pollution control strategy. The concept of Best Management Practice (BMP) for non-point source control and management was endorsed. To prevent water pollution from rural nonpoint sources, it was felt necessary to develop BMP's tailored to meet New York's unique physical, economic and agricultural conditions; to identify serious nonpoint water quality problems for spatial priority attention; and to invite participation by every landowner in the existing cooperative soil and water conservation program. It was concluded that since technically nonpoint pollution control is a new and relatively unexplored area of concern, the initial BMP systems must be carefully designed to stay within the limits of current knowledge. (See also W79-09185) (Skogerboe-Colorado State)
W79-09188

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE: AN INTEGRATED OVERVIEW,
Environmental Research Lab., Athens, GA.
G. W. Bailey, and T. E. Waddell.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 33-56, 1979. 5 fig, 3 tab, 17 ref.

Descriptors: Water management(Applied), *Water pollution control, Water pollution sources, Legislation, *Social aspects, Economic feasibility, Institutional constraints, Forest management, *Farm practices, *Forest practices.

The evolution of agricultural and silvicultural practices was examined to place the environmental effectiveness of BMPs in perspective within today's control efforts. In addition, recent legislation was reviewed in terms of BMP identification, selection, and implementation approaches. The technical, social, and economic aspects of BMPs were examined by means of a systems approach. First, the physical system characterized by natural and man-made inputs, system properties (e.g., topography and soil) and outputs/pollutant loads (i.e., sediment, pesticides, plant nutrients, heavy metals, pathogens and easily oxidizable organics) were discussed. Second, this system was viewed as a partially controllable system within the context of a larger socio-economic setting driven by a multiplicity of exogenous forces. Socio-economic aspects of BMPs were discussed in terms of economic efficiency, social acceptability, equity, implementation incentives, and institutional arrangements. The paper identified and discussed a number of critical issues that demand attention. (See also W79-09185) (Skogerboe-Colorado State)
W79-09190

CONSERVATION DISTRICT INVOLVEMENT IN 208 NONPOINT SOURCE IMPLEMENTATION,
National Association of Conservation Districts, Washington, DC.
R. E. Williams, and J. E. Lake.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 57-67, 1979.

Descriptors: *Water pollution control, Water quality act, Water law, Legislation, Water management(Applied), Erosion control, Sediment control, Water pollution sources, Soil conservation, *Nonpoint sources, Farm practices.

A brief history of the establishment of conservation districts was presented including their authorities under the state laws enabling conservation districts organization. In addition, fifteen states have passed additional legislation providing districts with the authority to participate in special erosion and sediment control programs. Examples of how these programs are working in several of the states were discussed. The relationships of these and other programs with the new thrust toward implementing nonpoint water quality plans using the Best Management Practice approach was covered. Three case studies were presented where districts have demonstrated their abilities to be management agencies for implementing Best Management Practices. Finally, conservation districts' involvement in carrying out 208 nonpoint implementation as a result of recent legislation (ex: Culver amendment) was provided. Administrative, technical, and funding roles of state soil conservation agencies and conservation districts in implementing BMP's were stressed. (See also W79-09185) (Skogerboe-Colorado State)
W79-09191

ANIMAL MANURE MOVEMENT IN WINTER RUNOFF FOR DIFFERENT SURFACE CONDITIONS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
D. B. Thompson, T. L. Loudon, and J. B. Gerrish.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 145-157, 1979. 1 fig, 4 tab, 16 ref.

Descriptors: *Agricultural runoff, *Nutrient removal, Runoff, Return flow, Water quality control, Chemical oxygen demand, Chemical degradation, Nonpoint sources, *Livestock wastes.

This experiment was designed to observe the impact of selected management practices on winter runoff quality. The effects of various surface conditions and buffer zones on runoff quality associated with land application of animal waste on frozen, snow-covered soil were evaluated. Three different surface covers with two lengths of buffer zone were compared as management practices which could be utilized for the reduction of nutrients contained in runoff from land application areas. The surface conditions used for the plots were corn stalk stubble with rows running across the slope, corn stalk stubble which had been fall disked across the slope, and established orchard grass. Runoff samples were analyzed for concentrations of ammonia, total Kjeldahl nitrogen, total phosphorus, chemical oxygen demand (COD), total and volatile solids. Twelve plots were established on a Hillsdale sandy loam soil with a 3.5% slope. The plots were 3 x 58 meters with the upslope 3 x 24 meters receiving the manure application. Four plots were used for each surface condition, two control and two spread with 62.7 M ton/ha of fresh dairy manure. The results of the experiment have been reported with discussion. (See also W79-09185) (Skogerboe-Colorado State)
W79-09197

ESTIMATION AND MANAGEMENT OF THE CONTRIBUTION BY MANURE FROM LIVESTOCK IN THE ONTARIO GREAT LAKES BASIN TO THE PHOSPHORUS LOADING OF THE GREAT LAKES,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
D. W. Draper, J. B. Robinson, and D. R. Coote.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 159-174, 1979. 2 fig, 4 tab, 39 ref.

Descriptors: *Agricultural runoff, Nutrient removal, Phosphorus, *Livestock wastes, *Great Lakes, Nonpoint sources, Feed lots.

As part of the work of the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG) a simple model has been developed for estimating contributions of total phosphorus to Great Lakes tributary loading originating with livestock manure produced in the Basin. Total loads attributable to livestock sources and a range of probable unit loads on a per animal unit per year basis were calculated. (See also W79-09185) (Skogerboe-Colorado State)
W79-09198

ESTIMATING PHOSPHORUS LOADING FROM LIVESTOCK WASTES: SOME WISCONSIN RESULTS,
Wisconsin Univ.-Madison. Water Resources Center.
I. C. Moore, F. W. Madison, and R. R. Schneider.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 175-192, 1979. 3 fig, 7 tab, 17 ref.

Descriptors: *Livestock wastes, Water pollution control, Water quality control, *Phosphorus, Agricultural watersheds, Pollutant identification, *Agricultural runoff, Analytical techniques, Nonpoint sources.

A description of an approach used to estimate phosphorus loading to the Great Lakes from livestock wastes in Wisconsin was presented. The results reported represent minimum annual loadings of total phosphorus to Lake Superior and Lake Michigan from areas of Wisconsin in these drainage basins. Estimates of the total phosphorus reaching surface waters from manure sources in the rest of the state were made on a per animal unit basis. The analytical techniques employed were reported separately. The emphasis was placed on the data requirements of the analysis. A key assumption of the methodology is that phosphorus in surface runoff will be linearly attenuated as long as the overland flow remains unchannelized. Thus, data on the location of barnlots and manure-spread fields with relation to surface features capable of channelizing flow were considered to be of primary importance. Problems encountered in determining this distribution of animal concentrations with respect to channels over a large and physiographically diverse region were discussed. (See also W79-09185) (Skogerboe-Colorado State)
W79-09199

PHOSPHORUS--A POTENTIAL NONPOINT SOURCE POLLUTION PROBLEM IN THE LAND AREAS RECEIVING LONG-TERM APPLICATION OF WASTES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
K. R. Reddy, R. Khaleel, and P. W. Westerman.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 193-211, 1979. 7 fig, 7 tab, 29 ref.

Descriptors: *Phosphorus, Water quality, Runoff, Water pollution sources, Nutrients, *Livestock wastes, Nonpoint sources.

The main objective was to describe the P behavior in the soils treated with wastes and their relationship to the surface water quality. The results obtained from these studies indicated that application of animal wastes decreased P sorption capacity of the soil and increased P concentration in the soil solution, thus increasing the equilibrium P concentration (EPC), at which no net adsorption or desorption takes place. A significant relationship was observed between EPC values and P extracted with dilute acid (0.05 N HCl + 0.025 N H_2SO_4). Continuous application of wastes with high load-

ing rates of P resulted in P movement into deeper layers. Transport of P either into deeper soil layers or in the surface runoff water was dependent on the availability of soluble P in the soil surface at the time of rainfall event. Simple equations were developed to describe the availability of P at the soil surface, and the processes controlling P availability were also taken into consideration. (See also W79-09185) (Skogerboe-Colorado State)
W79-09200

NUTRIENT AND PESTICIDE MOVEMENT FROM FIELD TO STREAM: A FIELD STUDY,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, H. P. Johnson, M. A. Borcherding, and W. R. Payne.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 213-245, 1979. 10 fig, 7 tab, 21 ref.

Descriptors: *Nutrient removal, *Pesticide removal, *Agricultural runoff, Hydrologic aspects, Nitrogen, Phosphorus, Mathematical models, Sedimentation, Nonpoint sources.

The general objective is to provide a better understanding of the relationships between management farm systems and stream water quality and to enable analysis of such systems using mathematical models. Specific objectives are (1) to collect data to refine an Agricultural Runoff Model proposed by U.S. Environmental Protection Agency; (2) to relate runoff and soil-erosion nutrient (nitrogen and phosphorus) losses to hydrologic factors as altered by land management; (3) to relate losses of pesticides in runoff to pesticide properties and to hydrologic and management factors; and (4) to relate sedimentation to hydrologic and management factors. The study was described and initial results were presented. (See also W79-09185) (Skogerboe-Colorado State)
W79-09201

THE FATE OF NITRATE IN SMALL STREAMS AND ITS MANAGEMENT IMPLICATIONS,
Guelph Univ., (Ontario). Dept. of Environmental Biology.
J. B. Robinson, H. R. Whiteley, W. Stammers, N. K. Kaushik, and P. Sain.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 247-259, 1979. 6 fig, 2 tab, 20 ref.

Descriptors: *Nitrates, Nitrogen, Nitrogen cycle, Streams, Laboratory tests, Management, Denitrification, Nutrient removal.

The present paper is a continuation of earlier investigations conducted by the authors on nitrogen transformations in stream-sediment-water systems. This paper provides further evidence for significant amounts of nitrogen loss during transport in streams and indicates the stream management options which should enhance the process. (See also W79-09185) (Skogerboe-Colorado State)
W79-09202

AN APPROACH TO WATER RESOURCES EVALUATION OF NONPOINT SOURCES FROM SILVICULTURAL ACTIVITIES--A PROCEDURAL HANDBOOK,
Science and Education Administration, Fort Collins, CO.
J. B. Currier, L. E. Siverts, and R. C. Maloney.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 271-280, 1979. 1 fig, 1 ref.

Descriptors: Water pollution control, Water pollution sources, *Forest watersheds, Forest management, Soil erosion, Streamflow, Sediment discharge, Dissolved oxygen, Methodology, *Nonpoint sources, *Forest practices.

This handbook provided an analysis methodology that can be used to describe and evaluate the changes to the water resource due to nonpoint sources from silvicultural activities. It covered only the pollutant generation and transport processes and did not consider the economic, social and political aspects of pollution control. It provided quantitative techniques for estimating potential changes in streamflow, surface erosion, mass wasting, total potential sediment discharge, and temperature. Qualitative discussions of the impacts of silvicultural activities on dissolved oxygen, organic matter, nutrients, and introduced chemicals were also included. A control section provided a list of demonstrated effective control practices and a methodology to be used to select mixtures of these controls for the prevention and mitigation of water resource impacts. Such mixtures are the technical basis for formulating 'Best Management Practices' (BMP's). Because economic, social, and political analyses were not discussed in this chapter, the resulting mixtures of controls are not BMP's. (See also W79-09185) (Skogerboe-Colorado State)
W79-09204

NONPOINT SOURCE POLLUTION FROM AGRICULTURE: SOME SOCIOLOGICAL CONSIDERATIONS FOR IMPLEMENTING POLICY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
J. C. van Es, and L. C. Keasler.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 311-319, 1979. 1 fig, 8 ref.

Descriptors: Water pollution control, Social aspects, Social participation, Water quality control, Water policy, Water management(Applied), *Nonpoint sources, *Agricultural runoff.

Most of the discussion on NPS pollution control deals with the economics and the technical aspects of the issue. In this paper the contributions sociological analysis can make to the administration and implementation of a NPS-pollution control program were demonstrated. The first theme developed dealt with the distinction between policy goals and the objectives of specific programs created to reach the policy goals. The second theme dealt with the issue of participation in programs. The paper discussed the experience in agriculture with voluntary and mandatory programs of change and the likely consequences of choosing programs with voluntary or mandatory participation strategies. It was concluded that the program administrators will be in a better position to administer programs if they understand the relationship of the program objectives to the policy goal and make program implementation compatible with the various programs objectives. (See also W79-09185) (Skogerboe-Colorado State)
W79-09207

SOCIAL COSTS AND EFFECTIVENESS OF ALTERNATIVE NONPOINT POLLUTION CONTROL PRACTICES,
Economics, Statistics, and Cooperative Service, Ames, IA.
K. F. Alt, J. A. Miranowski, and E. O. Heady.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 321-327, 1979. 1 tab, 11 ref.

Descriptors: Water pollution control, Water quality control, *Social aspects, Cost comparisons, Cost-benefit analysis, Alternative costs, Social impact, Environmental control, *Nonpoint sources.

A study was undertaken to estimate the magnitude of the farm production cost adjustments that would result from implementing specific environmental policies in an intensively cropped river basin of about 940,000 acres in East-Central Iowa. A linear programming model was used to simulate the crop growing and erosion management activities of the area. An exponential abatement cost function resulted for the total cost of reducing the sedimentation rate of a reservoir at the mouth of the watershed. Some of the pollution control policies considered in the study did not restrict the farmer's choice to that particular crop management system which was most effective from an engineering standpoint. It was concluded that the choice of future pollution control policies needs to be based on the costs changes incurred by farmers as well as the administration and surveillance costs incurred by the public agency which administers the pollution policy, and therefore, a truly optimal choice among alternative pollution control policies can only be made when the total of all public and private costs is weighed against the total of all benefits received. (See also W79-09185) (Skogerboe-Colorado State)
W79-09208

MANAGEMENT AND FINANCING OF AGRICULTURAL BMPS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 6E.
W79-09209

FARM-LEVEL ECONOMIC EVALUATION OF EROSION CONTROL AND REDUCED CHEMICAL USE IN IOWA,
Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 3F.
W79-09211

ECONOMIC IMPACTS OF POLICIES TO CONTROL EROSION AND SEDIMENTATION IN ILLINOIS AND OTHER CORN-BELT STATES,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 4D.
W79-09212

THE POLICY RELEVANCE OF ALTERNATIVE INSTITUTIONAL APPROACHES TO 208 PLANNING,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09215

ECONOMIC, INSTITUTIONAL AND WATER QUALITY CONSIDERATIONS IN THE ANALYSIS OF SEDIMENT CONTROL ALTERNATIVES: A CASE STUDY,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4D.
W79-09216

INSTITUTIONAL AND TECHNICAL ASPECTS OF THE DEVELOPMENT OF AGRICULTURAL BMPS IN A FIVE-COUNTY RURAL/URBAN MICHIGAN REGION,
Williams and Works, Inc., Grand Rapids, MI.
J. P. Jones, and J. C. Sutherland.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 455-462, 1979. 2 fig.

Descriptors: *Runoff, *Soil erosion, Waste treatment, Management, Water pollution control, Water law, *Michigan, Nonpoint sources, *Farm practices.

This is a case history of the development of a management oriented Waste Treatment Plan under the provisions of Section 208 of Public Law 92-500. It emphasized the management organization at all levels--state, regional and local--for the implementation of best management practices to control nonpoint diffuse sources of water pollution. Major emphasis of the control and management effort was directed toward urban and rural runoff and sedimentation; agricultural pollution such as that from herbicides and pesticides; pollution from construction practices and lesser nonpoint sources of water pollution such as septic systems and sanitary landfills. (See also W79-09185) (Skogerboe-Colorado State)
W79-09217

THE EVALUATION OF BEST MANAGEMENT PRACTICES FOR THE REDUCTION OF DIFFUSE POLLUTANTS IN AN AGRICULTURAL WATERSHED,
Resource Management Associates, West Chester, PA.
T. H. Cahill, R. W. Pierson, Jr., and B. Cohen.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 465-490, 1979. 14 fig, 9 tab, 10 ref.

Descriptors: *Agricultural watersheds, Land management, Water quality, Water quality control, *Agricultural runoff, Eutrophication, Lake Erie, Model studies, Great Lakes, *Nonpoint sources, *Farm practices.

The Honey Creek Watershed (180 s.m.) in the Sandusky basin of north central Ohio has been the subject of research by several agencies and institutions during 1976 and 1977. The basin has served as a pilot study area for the development of agricultural land management practices to reduce phosphorus input to Lake Erie. A computerized land resource data base has been created to evaluate options. Current research centers on the calibration of the EPA Non-point Source Model (NPS) for the watershed, with model parameter evaluation for BMP sensitivity. Because of the size of the basin with respect to prior NPS model calibration studies, 14 subbasin simulations were produced using the data base. Routing sub-routines were developed, using wave velocity for hydrographs and particle velocity for chemographs. Recommendations were made for model parameter inputs, to reflect greater sensitivity for management analysis. (See also W79-09185) (Skogerboe-Colorado State)
W79-09218

SEDIMENT AND NUTRIENT CONTRIBUTIONS TO THE MAUMEE RIVER FROM AN AGRICULTURAL WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
D. W. Nelson, E. J. Monke, A. D. Bottcher, and L. E. Sommers.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 491-505, 1979. 1 fig, 9 tab, 8 ref.

Descriptors: *Sediment discharge, Sediment load, Nutrient removal, *Agricultural watersheds, *Agricultural runoff, Sediment transport, Water pollution sources, Indiana, *Nonpoint sources, Maumee River.

Total amounts of water, sediment, and nutrients discharged from two subwatersheds of the Black Creek study area (5000 ha) Allen County, Indiana, were determined during 1975 and 1976. Above average precipitation was experienced during 1975, whereas 1976 was unusually dry. From 400 to 3700 kg of sediment/ha/yr was lost from the subwatersheds; land slope being the dominant factor in soil loss during the wet year and land use being the primary factor in drier year. Most of the total P transported was sediment-bound P, whereas a substantial proportion to total N in discharge water was nitrate. A few large rainfall events contributed to the transport of a high proportion of sediment and sediment-bound nutrients; whereas snow melt runoff accounted for disproportionally high transport of soluble nutrients. Surface runoff was the major source of sediment, sediment-bound nutrients, ammonium N and soluble organic N and P transported from the subwatersheds. Significant proportions of nitrate N originated from tile drainage and interflow, particularly in the more intensely cultivated subwatershed. A substantial proportion of soluble inorganic P was derived from septic tank effluent in one subwatershed. The relationship between fertility practices in the subwatersheds and quality of water being discharged was discussed. It was concluded that the effects of agricultural nonpoint source pollution and point source pollution on water resources are sufficiently different that direct comparisons between them cannot be made. (See also W79-09185) (Skogerboe-Colorado State)
W79-09219

WATER QUALITY MODELING IN THE DELAWARE COASTAL PLAIN REGION,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter, and P. A. Jensen.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 507-524, 1979. 7 fig, 3 tab, 24 ref.

Descriptors: *Agricultural runoff, Model studies, Water quality, Nitrogen, Simulation analysis, Storm runoff, Nitrogen cycle, Coastal plains, *Delaware, *Nonpoint sources.

A study of nonpoint modeling and the effect nonpoint sources have on water quality was conducted for the Coastal Sussex County 208 Water Quality Program. The EPA Agricultural Runoff Model was used in conjunction with a one dimensional water quality model of eleven parameters (NH4-N, NO2-N, NO3-N, phytoplankton-N, benthic N, herbivore N, particulate organic N, dissolved organic N, ultimate BOD, dissolved oxygen and total coliform) to analyze the effects of land use changes on water quality. The ARM Model and water quality model were used in Indian River Bay, Little Assawoman Bay, Rehoboth Bay and the Broadkill River. The ARM Model gave satisfactory results for runoff simulation, but did not give satisfactory results for nitrogen and phosphorus nonpoint source loads. A simulation study indicated that there would be no major water quality effects resulting from 20 year projected increases in urban areas or other land use changes. (See also W79-09185) (Skogerboe-Colorado State)
W79-09220

ESTIMATION OF AGRICULTURAL NONPOINT LOADS TO THE WAKARUSA RIVER BASIN USING THE 'NONPOINT CALCULATOR',
Midwest Research Inst., Kansas City, MO.
M. J. Davis, and J. W. Nebgen.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 525-550, 1979. 1 fig, 14 tab, 2 ref.

Descriptors: Water pollution control, Land management, Programs, *Agricultural watersheds, Sediment load, Pollutants, Kansas, *Nonpoint sources, Wakarusa River(KA).

An analysis of the nonpoint pollution sources in the Wakarusa River basin in eastern Kansas was undertaken. The Wakarusa basin is primarily rural, with the principal nonpoint pollutant loads arising from agricultural land. Soil Conservation Service information was used to develop the 'nonpoint calculator', a computerized methodology for estimating nonpoint loads. This procedure was developed under the sponsorship of the U.S. Environmental Protection Agency. The nonpoint calculator considers a variety of sources; pervious areas (erosion-related pollutants), impervious areas (urban sources), feedlots, landfills, salinity from irrigation return flow, and acid mine drainage. For the Wakarusa River basin study, the nonpoint calculator was used only for pervious agricultural land. The presentation described how the nonpoint calculator operates, and the type of information needed for input. It was shown that analysis of the output from the nonpoint calculator can pinpoint areas which require the development of plans for load reduction, either to preserve water quality or to maintain the soil resource. (See also W79-09185) (Skogerboe-Colorado State)
W79-09221

APPROACH FOR ANALYZING AND MANAGING AGRICULTURAL NONPOINT SOURCES IN THE STATE OF MARYLAND,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
R. F. Schoenhofer, W. A. Knight, and C. V. Hancock.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 551-561, 1979. 2 fig, 9 ref.

Descriptors: Water pollution control, Water quality control, Water quality act, Water pollution sources, *Maryland, Management, Decision making, *Planning, Agricultural chemicals, *Nonpoint sources.

This paper covered the following topics: (1) A description of the State of Maryland, its 208 planning areas and agencies, and a brief history of nonpoint source control efforts before the onset of 208 planning, which was prompted by P.L. 92-500; (2) A description of the organizational structure of the agencies involved in 208 planning as it relates to agriculture; (3) A description of the philosophy and the benchmark decisions relating to the development of the agricultural nonpoint source management program; and (4) A description of an information management system developed by the 208 program in cooperation with the Soil Conservation Districts, and its application as a part of program development. (See also W79-09185) (Skogerboe-Colorado State)
W79-09222

DEVELOPMENT OF A '208 PLAN' FOR AGRICULTURAL NONPOINT POLLUTION SOURCES IN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
D. H. Vanderholm, J. F. Frank, and A. G. Taylor.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 563-580, 1979.

Descriptors: Water pollution control, Water quality control, *Planning, Pollution abatement, Water pollution sources, Soil conservation, *Illinois, *Nonpoint sources, Farm practices.

In June 1976, a task force on Agricultural Non-Point Sources of Pollution was appointed to advise the Illinois Environmental Protection Agency in producing a comprehensive water pollution control plan. Task force membership included representatives from agriculture, state and federal agencies, universities, and environmental groups. The task force was divided into subcommittees to deal with the specific areas of pesticides, soil erosion, fertilizers, livestock waste, and forestry and fruit production. The problem assessment phase of the plan was completed in March of 1977 and the recommended Best Management Practices (BMPs) were completed in October, 1977. The last phase of the report deals with recommended implementation methods and was completed in March 1978. The objective of this paper was to report the approach used by the task force for assessment of the pollution problem from agricultural nonpoint sources, suggested BMPs, and implementation strategy as recommended by the task force for adoption in Illinois. (See also W79-09185) (Skogerboe-Colorado State)
W79-09223

EVALUATION OF CONTROLS FOR AGRICULTURAL NONPOINT SOURCE POLLUTION,
Meta Systems, Inc., Cambridge, MA.
J. J. Wineman, W. Walker, J. Kuhner, D. V. Smith, and P. Ginberg.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 599-624, 1979. 8 fig, 5 tab, 10 ref.

Descriptors: *Methodology, Assessments, Model studies, Alternative planning, Water pollution, Water quality control, Evaluation, *Nonpoint sources, *Agricultural runoff, Farm practices.

A proposed methodology for assessing the water quality and socioeconomic impacts of agricultural practices was described and tested in a case study based on corn belt farming in northeastern Indiana. The potential use of the methodology to evaluate agricultural nonpoint source pollution control policies and the effects of alternative futures was illustrated. The development of such a methodology for state level planning appeared feasible and to be of significant value for broad analyses of large

numbers of policy alternatives, including identification of Best Management Practces. However, the methodology was at a preliminary stage of development when this report was presented. (See also W79-09185) (Skogerboe-Colorado State)
W79-09225

MATHEMATICAL MODELING OF WATER QUALITY EFFECTS OF AGRICULTURAL BEST MANAGEMENT PRACTICES,
URS Co., Seattle, WA.
C. Tang.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 625-647, 1979. 6 fig, 5 tab, 5 ref.

Descriptors: Water quality control, Water pollution control, *Mathematical models, Agricultural runoff, Biochemical oxygen demand, Ammonia, Coliforms, *Nonpoint sources, *Farm practices.

A series of computer models were used in the SNOMET/King County (Washington State) 208 study to determine the water quality effects of the implementation of best management practices (BMPs) designed to reduce nonpoint pollutant runoff from agricultural activities. Simulated results showed that under existing land use conditions, the pollutant reductions for BOD, ammonia and fecal coliform loads in the study area after BMP application were about 70%, 85% and 75%, respectively. Under the simulation condition, a combination of 7 day - 10 year low flow regime and an annual summer storm, the results showed that the in-stream concentration of fecal colforms after BMP application in the Upper Snohomish River, was greatly improved from a frequent violation to a satisfactory level with respect to the State Standards. The results of these simulations helped to guide in the selection of BMPs for the agricultural areas. (See also W79-09185) (Skogerboe-Colorado State)
W79-09226

METHODOLOGY FOR DETERMINING THE OPTIMAL MIX OF BMP'S AND AGRICULTURAL PRODUCTION MODIFICATIONS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 6A.
W79-09227

MODELING NUTRIENT EXPORT IN RAINFALL AND SNOWMELT RUNOFF,
Cornell Univ., Ithaca, NY.
D. A. Haith, and L. J. Tubbs.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 665-685, 1979. 3 fig, 11 tab, 22 ref, 19 equ.

Descriptors: Nutrient removal, *Agricultural watersheds, *Mathematical models, *Agricultural runoff, Model studies, *Snowmelt.

Several mathematical models are available for the prediction of nutrient losses from agricultural watersheds. Most models have complex structures, require large computer programs and data banks and must be calibrated using streamflow data. There are obvious advantages, at least for planning purposes, in simpler modelling approaches with modest data and computational requirements. One such approach, which was evaluated in this paper, is the estimation of runoff from each unit source area within a watershed, multiplication of these runoff estimates by appropriate nutrient concentrations and summing the resulting mass fluxes for all source areas in the watershed. The approach is roughly equivalent to a distributed watershed model in which all flows are instantaneously routed to the watershed outlet. Mass fluxes of dissolved nitrogen, dissolved phosphorus and total phosphorus from agricultural runoff were estimated for each storm during a period of 18 months in 1972-1974 for the Fall Creek Watershed in upstate New York. The nutrient flux estimates were compared with measured nutrient exports from the watershed determined from water quality samples. (See also W79-09185) (Skogerboe-Colorado State)
W79-09228

MODELING SOIL AND WATER CONSERVATION PRACTICES,
Hydrocomp, Inc., Palo Alto, CA.
D. C. Beyerlein, and A. S. Dinigian.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 687-713, 1979. 9 fig, 4 tab, 16 ref.

Descriptors: *Agricultural runoff, Water conservation, Soil conservation, *Model studies, Agricultural watersheds, Sediment discharge, Frequency analysis, *Watershed management, Nonpoint sources, Farm practices.

The U.S. Environmental Protection Agency's Agricultural Runoff Management (ARM) Model was used to study the effects of soil and water conservation practices (SWCP) on nonpoint pollution from agricultural lands. The base conditions were defined as conventional agricultural practices for the region. Model parameters were then changed to represent the effects of a particular SWCP. The three major SWCPs studied were terracing, contouring, and conservation tillage. Continuous simulations of three to ten years in length were made to quantify the effects of each of the SWCPs compared to the base conditions. Runoff, sediment loss, and pesticide and nutrient washoff in solution and on sediment for a SWCP were compared with the base condition results. Results were analyzed both by total monthly and yearly amounts and by frequency of occurrence. ARM Model results were displayed with a Calcomp plotter to give a visual representation of how and when runoff and pollutant amounts changed with different SWCPs. The simulation methodology, the selection and evaluation of model parameters for particular practices, and the evaluation of the results in terms of the effects of different SWCPs were discussed. Limitations of the model to represent certain agricultural practices were presented along with areas for future research. (See also W79-09185) (Skogerboe-Colorado State)
W79-09229

INTERACTIVE EFFECTS OF PESTICIDE PROPERTIES AND SELECTED CONSERVATION PRACTICES ON RUNOFF LOSSES: A SIMULATION STUDY,
Environmental Research Lab., Athens, GA. Technology Development and Applications Branch.
J. D. Dean, and L. A. Mulkey.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 715-734, 1979. 7 fig, 3 tab, 28 ref.

Descriptors: *Agricultural runoff, *Pesticide removal, Conservation, Simulation analysis, Agricultural chemicals, Management, Sediment discharge, Water pollution control.

The prohibitive cost of long-term collection of chemical runoff data from agricultural activities makes the use of models attractive in evaluating impacts of management practices. This paper described a general methodology for model implementation and cited a specific case to indicate the potential of simulation studies for characterizing runoff losses. To test the methodology, a study was made using two different conservation practices on opposite ends of the managerial spectrum, three different sorptive pesticide properties, ten gradually increasing pesticide half-lives, and three meteorological input sequences for a total of 180 simulation years. The U.S. Environmental Protection Agency's Agricultural Runoff Management Model (ARM) and data from the Southern Piedmont agricultural region were used in the investigation. Results showed the interactive effects of pesticidal properties, watershed hydrology, and conservation practices on runoff losses of the chemicals, in water and on sediment. (See also W79-09185) (Skogerboe-Colorado State)
W79-09230

OCCURRENCE AND DISTRIBUTION OF HUMAN BACTERIAL PATHOGENS IN VIRGINIA SURFACE WATERS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
S. L. Wendt, B. C. Parker, and J. O. Falkinham, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 136, Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia, Polytechnic Institute and State University, Bulletin 118, July 1979, 68 p. 3 fig, 29 tab, 48 ref. OWRT B-098-VA(1).

Descriptors: Aerosols, Mycobacteria, Environmental biology, *Pathogenic bacteria, *Coliforms, Surface waters, Virginia, Rain water.

This study surveyed the year-round occurrence and distribution of coliforms, fecal coliforms, total bacteria, and atypical mycobacteria detected from fresh, brackish, and marine waters in Virginia. The study also sought to evaluate the effectiveness of sampling surface microlayer waters relative to standard sampling of subsurface waters for detecting human bacterial pathogens. Past research has demonstrated that bacteria can be transferred from water to air by adsorption on gas bubbles that rise from the subsurface to the microlayer, and then burst at the water/air interface. The bacteria thus are ejected into the atmosphere to be dispersed by winds to other sites. Although most previous investigations have concentrated on this phenomenon as it occurs in seawater, this research dealth with the transfer of bacteria from freshwater to air. Coliform and fecal coliform bacteria showed no correlation with numbers of mycobacteria and total bacteria. Coliform and fecal coliform numbers consistently remained within permissible standards, and the potential pathogen, Pseudomonas aeruginosa, was isolated only in low numbers. Mycobacteria biochemically identical to known human pathogens were found in aerosols, rainwater, surface waters, and microlayer waters, including waters associated with treated sewage effluent. The most significant finding of the investigation showed that appreciable numbers of potentially pathogenic mycobacteria can move from water to air as aerosols with size ranges capable of penetrating the alveoli of human lungs. This discovery supports the hypothesis that water-to-air transfer of atypical mycobacteria can be a significant pathway of human infection.
W79-09231

EAGLE LAKE POLLUTION CONTROL PROJECT: ASSESSMENT OF LAKE IMPROVEMENT,
Minnesota Univ., Morris. Div. of Science and Mathematics.
For primary bibliographic entry see Field 2H.
W79-09232

THE IMPACT OF URBANIZATION ON THE DISTRIBUTION OF HEAVY METALS IN BOTTOM SEDIMENTS OF THE SADDLE RIVER,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W79-09233

WATER POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09320

MODELLING THE WATER QUALITY IN NEVA BAY,
Akademiya Nauk SSSR, Moscow.
E. V. Eremenko, V. A. Barannik, N. I. Selyouk, Y. M. Plis, and L. I. Lavrinenko.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 249-258, June 1979. 9 fig, 4 ref.

Descriptors: *Water quality, *Bays, *Model studies, *Mathematical models, Rivers, Flood protection, Estuaries, Pollutants, Oxygen, Dissolved oxygen, Nitrogen, Ammonia, Nitrates, Nitrites,

Oil, Phenols, Phosphorus, Biochemical oxygen demand, Distribution patterns, Spatial distribution, *Neva River(USSR), *Neva Bay(USSR), *USSR.

To evaluate the effects or proposed flood protection structures at the mouth of the Neva River on the water quality in Neva Bay, a model was proposed which described the water quality processes in Neva Bay. The following indices were modelled: permanganate oxidation, ammonium nitrogen, nitrite nitrogen, nitrate nitrogen, oil products, phenols, dissolved oxygen, detergents, mineral phosphorus, and BOD. Field data were compared to the results obtained from the model, and predictions were made of the distribution of different parameters. (Sims-ISWS)
W79-09326

ENFORCEMENT OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 TO CONTROL NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09330

5C. Effects Of Pollution

LETHAL AND SUBLETHAL EFFECTS OF CADMIUM ON FRESHWATER CRUSTACEANS,
Monash Univ., Clayton (Australia). Dept. of Zoology.
P. S. Lake, R. Swain, and B. Mills.
Australian Water Resources Council Technical Paper No. 37, 1979. 213 p, 24 fig, 60 tab, 364 ref. Australian Government Publishing Service, Canberra. 74/71.

Descriptors: *Cadmium, *Toxicity, *Water pollution effects, Water pollution sources, Crustaceans, Aquatic animals, Freshwater, Amphipoda, Invertebrates, Mortality, Shrimp, Environmental effects.

The current knowledge of cadmium as a toxic element for fish and aquatic invertebrates is detailed including the results of a study involving two freshwater species. Brief reviews of the general distribution of cadmium in the environment, the chemical properties and distribution of cadmium in the aquatic environment, and the action of cadmium as a human pollutant are given. The 96-hr LC50 for cadmium in a standard 'soft' water at 20C was determined for the amphipod Austrochiltonia australis and the decapod shrimp Paratya. Increases in the total ion, calcium, and magnesium concentrations of the test solutions affected acute toxicity in varying degrees; some did not markedly affect the toxicity and some decreased the toxicity to one or both species. Acute toxicity to Austrochiltonia increased with an increase in temperature. The molt stage most resistant to acute toxicity in Paratya was premolt. In amphipods concentrations of cadmium in the body at death increased with increasing concentrations of cadmium in the test solution. The 'lowest unsafe' chronic concentration of cadmium appeared to be 0.001 mg Cd/l. Low concentrations of cadmium inhibited somatic growth of amphipods, and caused a decrease in food consumption, fecal pellet production, and locomotory activity. (Schaefer-IPA)
W79-09082

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME 1: DISCUSSION,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
For primary bibliographic entry see Field 5E.
W79-09085

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME II: DATA REPORT,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
For primary bibliographic entry see Field 5E.
W79-09086

TOXICITY OF PULP AND PAPER MILL EFFLUENT: A LITERATURE REVIEW,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5A.
W79-09097

CASES OF MASS MORTALITY OF THE WALLEYE POLLOCK, THERAGRA CHALCOGRAMMA, IN THE SEA OF OKHOTSK,
Pacific Research Inst. for Fisheries and Oceanography, Magadan (USSR). Magadan Dept.
For primary bibliographic entry see Field 5B.
W79-09098

THE EFFECT OF MERCURIC CHLORIDE ON SOME BIOCHEMICAL INDICATORS OF THE BRAIN, BLOOD AND LIVER OF THE 'CASPIAN ROACH', RUTILUS RUTILUS CASPICUS,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Makhachkala (USSR). Dagestanskii Div.
V. K. Dokholyan, and T. P. Akhmedova.
Journal of Ichthyology, Vol. 18, No. 1, p 167-169, 1978. 2 tab, 9 ref.

Descriptors: *Toxicity, *Bioassay, Mortality, *Mercury, Metals, Freshwater fish, Fish physiology, Animal physiology, *Biochemistry, Nitrogen compounds, Water pollution effects, Ammonia, Glutamic acid, Proteins, Brain proteins, Albumins, Globulins, Blood.

Substantial changes occur in the organism of fish kept in mercury solutions. In a solution of 100 micrograms/l the fish perished, lower concentrations (10 and 5 micrograms/l) did not result in death, but they caused considerable disruption of the metabolism. Thus in the fish brain a considerable increase was noted in the content of ammonia, glutamic acid and the amide groups of brain proteins, and a decrease in glutamine and gamma-amino-butyric acid, while the amount of nitrogen metabolites in the brain of the test fish depends on the concentration of the toxicant, the age of the fish and the length of exposure. A decrease is observed in the total amount of protein, blood and albumins and a corresponding increase in alpha and beta globulins. The amount of sugar in the blood and glycogen in the liver decreases. The data indicate that pollution of the aquatic environment by mercury compounds may lead to a number of physiological-biochemical changes which are reflected in different physiological performances of the organism and may, in the end, result in a decrease in the fish productivity. (Katz-EIS)
W79-09099

COLCHICINE-INDUCED POLYPLOIDY IN BROOK TROUT,
Rhode Island Univ., Kingston. Dept. of Animal Science.
L. T. Smith, and H. L. Lemoine.
The Progressive Fish Culturist, Vol. 41, No. 2, p 86-88, 1979. 4 fig, 1 tab, 6 ref.

Descriptors: Bioassay, Mortality, Toxicity, Laboratory tests, *Colchicine, *Polyploidy, *Sterility, Water pollution effects, Fresh water fish, Brook trout, Fish management, Aquiculture, Fish control agents, Fish physiology, Fish reproduction, *Fish sterilants.

Fertilized eggs of brook trout before the first cleavage were challenged with 0.01% colchicine solution. The water temperature was 12 degrees C. There was an 11.3% increase in mortality resulting from the colchicine treatment. Polyploid cels were observed in four of six fish. Observations will be made to see if fish were sterile. (Katz-EIS)
W79-09100

TCDD IN THE ENVIRONMENT,
Power Authority of the State of New York.
D. Wallace, L. A. Norris, and C. L. Hawkes.
Transactions of the American Fisheries Society, Vol. 108, p 103-109, 1979. 43 ref.

Descriptors: *Toxicity, Mortality, Bioassay, On-site-investigation, *Dioxin, *2,4,5-T, Herbicides, Rainbow trout, Laboratory tests, *TCDD, 2,3,7,8-tetrachloro dibenzo-p-dioxin, Sediments, Biological concentration, Agricultural chemicals, Agricultural runoff, Forest management.

D. Wallace indicates that Norris and Hawkes, in an earlier paper, underestimate the amount and the effects of TCDD (2,3,7,8-tetrachloro-dibenzo-p-dioxin) that are discharged into the aquatic environment. Rainbow trout are not believed to be a suitable experimental animal upon which to base estimates. Norris and Hawkes observed that the ecological disasters suggested by Hawkes have not been observed in over 30 years of use of 2,4,5-T in forestry and agriculture. (Katz-EIS)
W79-09101

CHLORINE IN THE MARINE ENVIRONMENT,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman.
Oceanus, Vol. 22, p 36-43, 1979. 5 fig, 2 tab, 7 ref.

Descriptors: *Chlorine, Chlorination, *Marine plankton, Phytoplankton, Zooplankton, *Toxicity, Bioassay, Mortality, Juvenile fish, Juvenile growth stages, Larvae, Larval growth stages, *Bromine, Water pollution effects, Water pollution sources.

There is concern with the halogenated organic compounds discharged into the aquatic environment. Little is known of the effects of these compounds on marine species. The chemistry of free chlorine in sea water is complex. Chlorine reacts with bromine in sea water. The chlorine is used in power plants to control fouling organisms. The residual chlorine is discharged into the marine environment. Bioassays have been conducted at the Woods Hole Oceanographic Institution to determine the response of typical plankton organisms to chlorine discharges. Larval planktons and small fish are extremely sensitive to chlorine. (Katz-EIS)
W79-09102

METAL ACCUMULATION BY AQUATIC BRYOPHYTES FROM POLLUTED MINE STREAMS,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5A.
W79-09104

SEASONAL LEVELS OF CHLORINATED HYDROCARBONS AND HEAVY METALS IN FISH AND BROWN SHRIMPS FROM THE MEDWAY ESTUARY, KENT,
City of London Polytechnic (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W79-09105

BIOACCUMULATION OF AROCLOR 1016 IN HUDSON RIVER FISH,
New York State Dept. of Environmental Conservation, Rome.
For primary bibliographic entry see Field 5B.
W79-09106

IN VIVO RESPONSE OF ATPASES IN FEW TISSUES OF THE FISH MYSTUS VITTATUS (HAM.) TO THE SYNTHETIC DETERGENT SWACOFIX (R) E45 (ABS),
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5B.
W79-09107

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,

Provinciale Waterstaat van Gelderland Arnheim (Netherlands).
For primary bibliographic entry see Field 5A.
W79-09108

INFLUENCE OF STOCK DENSITY AND FOOD USED ON GROWTH OF CARP KEPT IN COOLING WATERS,
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
For primary bibliographic entry see Field 5A.
W79-09109

EGG SHELL CHARACTERISTICS OF GANNETS SULA BASSANA, SHAGS PHALACROCORAX ARISTOTELIS AND GREAT BLACK-BACKED GULLS LARUS MARINUS EXPOSED TO DDE AND OTHER ENVIRONMENTAL POLLUTANTS,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
For primary bibliographic entry see Field 5B.
W79-09110

EFFECT OF WATER TEMPERATURE ON THE INFECTION OF RAINBOW TROUT SALMO GAIRDNERI RICHARDSON WITH INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS,
Oregon State Univ., Corvallis. Dept. of Microbiology.
F. M. Hetrick, J. L. Fryer, and M. D. Knittel.
Journal of Fish Disease, Vol. 2, p 253-257, 1979. 1 tab, 7 ref.

Descriptors: *Rainbow trout, *Fish diseases, *Water temperature, Aquiculture, Fish hatchery, Thermal water, Bioassay, Laboratory test, Viruses, Fish conservation, Fish establishment, Fish farming, Fish physiology, Fish kill, Fresh water fish, Infectious haematopoietic necrosis virus.

Laboratory experiments with rainbow trout at water temperatures of 3, 6, 9, 12, and 15 degrees C indicate that they can be infected with infectious haematopoietic necrosis virus over a wide range of water temperatures. The use of elevated water temperatures does not seem to be a practical method of controlling IHN outbreaks. (Katz-EIS)
W79-09111

THE EFFECT OF PH ON OXYGEN CONSUMPTION AND ACTIVITY IN THE BATHYPELAGIC MYSID GNATHOPHAUSIAINGENS,
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-09112

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE THIRD U.S.-JAPAN EXPERTS' MEETING--NOVEMBER 1977--EASTON, MARYLAND,
For primary bibliographic entry see Field 5A.
W79-09113

PRESENT AND FUTURE WATER POLLUTION CONTROL PROJECTS IN JAPANESE RIVERS AND LAKES,
Ministry of Construction, Tokyo (Japan). River Improvement Div.
A. Kato.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 31-47, 1978. 12 fig, 5 tab, 2 ref.

Descriptors: *Water quality control, *Rivers, *Lakes, *Japan, Dredging, Sediments, Mercury, Polychlorinated biphenyls, Water quality, Regulation, Water quality standards, Water chemistry, Spoil banks.

Water pollution of public rivers and lakes in Japan has a magnified impact because of the limited water resources of the country. To prevent further deterioration of water quality, many water pollution control projects are being conducted under direct control or as grant-in-aid projects of the Ministry of Construction. A brief history of river pollution control projects was presented. Current projects and future long-term plans aimed at the improvement of the river environment were outlined. (See also W79-09113) (Deal-EIS)
W79-09115

TURBIDITY GENERATED BY DREDGING PROJECTS,
Ministry of Transport, Kobe (Japan). Bureau of Ports and Harbors.
For primary bibliographic entry see Field 5A.
W79-09116

RECENT PROGRESS IN TECHNIQUES FOR MANAGING CONTAMINATED BOTTOM SEDIMENTS,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5A.
W79-09117

DREDGING TOXIC SEDIMENTS IN YOKKAICHI PORT,
Yokkaichi Port Authority (Japan).
For primary bibliographic entry see Field 5A.
W79-09118

ACCUMULATION OF METHYL MERCURY IN RED SEA BREAM (CHRYSOPHRYS MAJOR) VIA THE FOOD CHAIN,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
For primary bibliographic entry see Field 5A.
W79-09119

THE RELATIONSHIP BETWEEN SEDIMENTS AND BENTHOS IN MIKAWA BAY,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5B.
W79-09120

A HYDRODYNAMIC STUDY OF LAKE POLLUTION,
Japan Bottom Sediments Management Association, Tokyo.
For primary bibliographic entry see Field 5B.
W79-09121

THE TOXIC SUBSTANCES CONTROL ACT (TSCA): HOW IT AFFECTS EPA FROM A RESEARCH AND ENFORCEMENT STANDPOINT,
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
E. I. Wallen.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland, Report No. EPA-600/3-78-084, p 147-152, 1978.

Descriptors: *Regulation, *Law enforcement, *Water quality standards, Water quality, Water quality control, Penalties(Legal), Polychlorinated biphenyls, Chemical analysis, Research priorities, Research and development.

The purpose of the law is primarily to gather health effects data and to make these data available to everyone--to citizens of the United States, to other countries, to any labor union member or to anyone who wishes to have the information. A second purpose of the Act is to gather new health effects information through the testing of toxic chemicals. A third objective is to control the chemical industry in the prevention of pollution. The law provides that research may be performed in any area necessary to support the purposes of the Act. This includes health effects research, epidemiological research, and discovery monitoring. In terms of enforcement, the EPA regional offices have substantial authority for inspection both within the normal court procedures and unexpectedly by entering a plant without a warrant. The law also bans the production of PCBs. (See also W79-09113) (Deal-EIS)
W79-09122

MITIGATION FEASIBILITY FOR THE KEPONE-CONTAMINATED JAMES RIVER, VIRGINIA,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
For primary bibliographic entry see Field 5B.
W79-09123

HUDSON RIVER - PCB STUDY DESCRIPTION AND DETAILED WORK PLAN,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5B.
W79-09124

AN OVERVIEW OF BOTTOM SEDIMENT PROBLEMS IN SAGINAW RIVER AND BAY, MARINETTE-MENOMINEE HARBOR, AND WAUKEGAN HARBOR,
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5A.
W79-09125

IMPACTS ASSOCIATED WITH THE DISCHARGE OF DREDGED MATERIAL INTO OPEN WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5A.
W79-09126

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO THE MARINE MACROBENTHOS,
Corvallis Environmental Research Lab., OR
For primary bibliographic entry see Field 5A.
W79-09127

EUTROPHICATION CONTROL: IMPORTANCE OF INTERNAL PHOSPHORUS SUPPLIES,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5B.
W79-09128

THE REGULATION GUIDELINES AND CRITERIA FOR THE DISCHARGE OF DREDGED MATERIAL: PREDICTION OF POLLUTION POTENTIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5B.
W79-09129

NORTH BRANCH POTOMAC RIVER BASIN MINE DRAINAGE STUDY--PHASE I, BASELINE SURVEY.
Skelly and Loy, Harrisburg, PA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 531, Price codes: A13 in paper copy, A01 in microfiche. Final Technical Report, May 1977. 295 p, 56 fig, 37 tab, 118 ref.

Descriptors: *Acid mine water, *Coal mines, *Water quality, *Aquatic habitats, Mine drainage, Reclamation, Simulation analysis, River basins, Planning, Surveys, Surface mines, Underground mines.

This survey of the mine drainage and related water resources of the North Branch Potomac River Basin established the extent, magnitude, and effects of coal mine drainage pollution. Alternative abatement and reclamation solutions were considered. The study included an analysis of socioeconomic and environmental conditions as related to the mine drainage problem. (Adams-ISWS)

W79-09144

ENERGY AND ENVIRONMENTAL STRESS IN AQUATIC SYSTEMS, SELECTED PAPERS FROM A SYMPOSIUM HELD AT AUGUSTA, GEORGIA, NOVEMBER 2-4, 1977.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-771114, Price codes: A00 in paper copy, A01 in microfiche. CONF-771114. DOE Symposium Series; 48. Thorp, J. H., and Gibbons, J. W., (Eds.). 854 p, 1978, Department of Energy, Technical Information Center, Oak Ridge, Tennessee.

Descriptors: *Environmental effects, *Conferences, Publications, Aquatic systems, Energy, Powerplants, Stress.

The proceedings includes a total of 49 papers which were presented at the symposium and which are devoted to the areas of modeling stresses, natural stresses and environmental fluctuations, fossil-fuel stresses, heavy-metal stresses, thermal stresses, and multiple and synergistic stresses. Author and subject indexes are included. (See W79-09236 thru W79-09284) (Chilton-ORNL)
W79-09235

MODELING ENVIRONMENTAL STRESS,
Maryland Univ., Solomons. Center for Environmental and Estuarine Studies.
R. E. Ulanowicz.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 1-18, 1978, 62 ref.

Descriptors: *Environmental effects, *Stress, *Model studies, Ecosystems.

This paper includes a discussion of environmental stress and ecosystem response to stress. Two classes of models are identified local (a model in which there is no explicit mention of a critical deviation, change in dimensionality or switch in function) and far-field (models in which the prominence of at least one of these characteristics is identifiable). It is stated that most ecosystem models fall into a low-level linear response category which does not provide sufficient information about sudden structural changes or structure after transition. It was concluded that macroscopic analyses of stressed ecosystems offer possible alternatives to compartmental models. (See also W79-09235) (Chilton-ORNL)
W79-09236

FREQUENCY RESPONSE OF A MARINE ECOSYSTEM SUBJECTED TO TIME-VARYING INPUTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
R. L. Dwyer, S. W. Nixon, C. A. Oviatt, K. T. Perez, and T. J. Smayda.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 19-38, 1978. 7 fig, 26 ref.

Descriptors: *Environmental effects, *Frequency analysis, Ecosystems, Model studies, Bays, Microcosm studies, Frequency responses, Time-varying inputs.

Time series of solar radiation, water temperature, ammonia and phytoplankton abundance from bay samples taken over a 17-year period and time series of ammonia and chlorophyll a from a 6-month sewage-perturbation experiment were analyzed by spectral analysis. Spectra for environmental inputs to the bay ecosystem showed periodicities only at 1 cycle/year while the spectrum for phytoplankton abundance showed additional significant periodicities at 2 and 4 cycles/year. These higher frequency processes appear to be harmonics of the fundamental driving frequency of 1 cycle/year. The presence of significant oscillations in the phytoplankton data at frequencies not found in any of the major environmental inputs indicates the existence of a nonlinearity in the primary production of the ecosystem. It was pointed out that a major difficulty in applying cross-spectral methods to data from natural ecosystems is that natural inputs fluctuate only at a few frequencies. Coherence between natural-input time series and ecological responses will be significant only at these frequencies. (See also W79-09235) (Chilton-ORNL)
W79-09237

APPLYING SURVIVAL CURVES TO ASSESSMENT OF FISH LARVAL ENTRAINMENT IMPACT,
NUS Corp., Pittsburgh, PA. Ecological Sciences Div.
M. D. Dahlberg.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 39-48, 1978. 1 fig, 2 tab, 15 ref.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Model studies, Mortality, Fish populations.

The potential effects of entrainment are generally assessed by translating entrained fish eggs and larvae to the potential number of adults they represent. These calculations are accomplished with complex models and a simplistic equivalent-adult method (Horst model). This paper examines problems encountered in applying the model and discusses alternative procedures. Accuracy of the model depends on the proper selection of methods for calculating larval losses, lifetime fecundity, and larva-to-adult survival. It is recommended that potential adult loss should be expressed as a possible range. The calculated adult losses can be compared with some reference for acceptability, such as year-to-year variation in population size. (See also W79-09235) (Chilton-ORNL)
W79-09238

A SIMPLE MODEL FOR ASSESSING THE POTENTIAL LOSS OF ADULT FISH RESULTING FROM ICHTHYOPLANKTON ENTRAINMENT,
Environmental Research and Technology, Inc., Concord, MA.
W. P. Saunders, Jr.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 49-61, 1978. 2 fig, 3 tab, 17 ref.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Mortality, Fish populations.

A revised form of the equivalent-adults model (Horst model) introduces several new assumptions which must be considered in using the model: survival corresponds to an exponential model during all planktonic life stages; all mortality during the first year of life occurs during the planktonic life stages; vulnerability of plankton to entrainment remains constant throughout the planktonic stages; plankton that are the victims of natural mortality are not entrained; and survival from egg to adult is an approximate estimator of first-year survival. Analysis of these assumptions shows that the model will overestimate impact, but such overestimates are considered acceptable in using this model as a preliminary impact-assessment tool. (See also W79-09235) (Chilton-ORNL)
W79-09239

STRESS AND ECOSYSTEMS,
Florida Univ., Gainesville. Dept. of Botany.
A. E. Lugo.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 62-101, 1978, 8 fig, 5 tab, 114 ref.

Descriptors: *Environmental effects, *Stress, Ecosystems, Energy budget, Reviews.

The paper presents a literature review which defines stress and stressors and the effects of stress on ecosystems. Stressors with highly concentrated energy sources which divert low-quality energy flows are said to have greater impact on ecosystems than stressors with diluted energy sources which impact high-quality energy flows. It is suggested that the best way to arrange and analyze ecosystems hierarchically accord to their capacity to develop complexity and tolerate stress is to classify them by their energy budgets. Emphasis is placed upon the fact that ecosystem management requires that studies be done at the ecosystem level with care to quantify the stressor and the stress in units of comparable energy quality. (See also W79-09235) (Chilton-ORNL)
W79-09240

ECOSYSTEM RESPONSES TO STRESS IN AQUATIC MICROCOSMS,
Georgia Univ., Athens. Inst. of Ecology.
J. W. Leffler.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 102-119, 1978. 2 fig, 5 tab, 19 ref.

Descriptors: *Environmental effects, *Stress, Model studies, Ecosystems, Aquatic life, Microcosms, Microcosm studies, Stress response.

This paper attempts to clarify the stress concept and advocates an empirical approach which requires that strict operational definitions be developed to clarify theoretical concepts. Microcosms are proposed as living models of large natural ecosystems which are potentially valuable tools for developing and testing theories of ecosystem dynamics. The use of aquatic microcosms to evaluate the stabilizing effects of species diversity and nutrient availability is described. No relationship could be demonstrated between resistance and resilience of stressed microcosms or between their steady-state variability and any measure of their perturbed behavior, suggesting that some hypotheses which seek to describe an ecosystem's stress response are incorrect and require clarification. (See also W79-09235) (Chilton-ORNL)
W79-09241

PHYSICOCHEMICAL AND BIOLOGICAL STRESSORS AS DISTRIBUTIONAL DETERMINANTS OF CARIBBEAN AND TROPICAL EASTERN PACIFIC SWIMMING CRABS,
Iowa Univ., Iowa City. Dept. of Zoology.
E. A. Norse.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 120-140, 1978. 2 fig, 4 tab, 33 ref.

Descriptors: *Environmental effects, *Stress, Aquatic life, Distribution patterns, Crabs, Pacific Ocean, Caribbean Ocean, Resistance, Biological stress, Physicochemical stress, Stress response.

Data from field studies indicate that Euphylax robustus in the Pacific and Portunus, Arenaeus, and Cronius spp. in the Pacific and the Caribbean occur predominately farther offshore, deeper or in higher salinities than Callinectes spp. High-temperature and desiccation tolerance appear to be less important than hyposalinity tolerances in permitting Callinectes to penetrate estuaries and shallow areas. The possibility of dilution limits distributions as stress increases. Increased interference and exploitation competition, predation, parasitism, food quality and abundance and interactions of these factors limit seaward distribution. It was concluded that biological stress increases as physicochemical stress decreases. (See also W79-09235) (Chilton-ORNL)
W79-09242

EFFECTS OF FLUCTUATING FLOW RATES AND WATER LEVELS ON CHIRONOMIDS: DIRECT AND INDIRECT ALTERATIONS OF HABITAT STABILITY,
Oklahoma Univ., Norman. Dept. of Zoology.
A. P. Covich, W. D. Shepard, E. A. Bergey, and C. S. Carpenter.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-

771114. p 141-156, 1978. 7 fig, 1 tab, 36 ref.

Descriptors: *Environmental effects, *Flow, Flow rates, Water levels, Diptera, Populations, Aquatic life, Reservoir releases.

Macroinvertebrates were collected from 7 stations on the Grand River and two of its tributaries in Oklahoma. Of the 122 taxa collected, 24 were Chironomids dominated by Glyptotendipes. Studies showed that fluctuations in water level and water flow resulting from reservoir discharge influenced the chironomid populations in both the discharge-receiving river and its tributaries. The greater the degree of fluctuations, the greater the effects appeared to be. Decreasing density, biomass, and numbers of genera characterized the most intensely fluctuating sites. (See also W79-09235) (Chilton-ORNL)
W79-09243

ENVIRONMENTAL IMPLICATIONS OF COAL-CONVERSION TECHNOLOGIES: ORGANIC CONAMINANTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. W. Gehrs.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 157-175, 1978. 5 fig, 2 tab, 39 ref. DOE W-7405-eng-26.

Descriptors: *Environmental effects, *Energy, *Coals, Organic compounds, Effluents, Chemistry, Coal conversion.

This paper describes coal-conversion technologies, identifies types of organic contaminants expected to be released, summarizes the literature on environmental effects and presents research strategy for addressing potential environmental effects. Two approaches are presented for studying the potential environmental impact of the hundreds, perhaps thousands, of individual compounds which may be present in aqueous effluents. These approaches involve testing the whole complex effluent or testing individual compounds. It was concluded that certain components from each of the two approaches must be used. Testing complex mixtures, coupled with chemical fractionation, allows for determination of acute toxicities and identification of active components in the effluent. Investigation of individual compounds becomes manageable by grouping of compounds on the basis of chemical structure. (See also W79-09235) (Chilton-ORNL)
W79-09244

THE STREAM ENVIRONMENT AND MACROINVERTEBRATE COMMUNITIES: CONTRASTING EFFECTS OF MINING IN COLORADO AND THE EASTERN UNITED STATES,
Colorado State Univ., Fort Collins.
J. V. Ward, S. P. Canton, and L. J. Gray.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. p 176-187, 1978. 3 fig, 3 tab, 16 ref. EPA R803950.

Descriptors: *Environmental effects, *Mining, Coal mines, Aquatic life, Colorado, Invertebrates, Water pollution, Mine wastes.

Species composition, diversity, and standing crop of macroinvertebrate communities in a Colorado stream were compared with these factors in streams in eastern states. The Colorado stream was generally characterized by low values of sulfate and iron, highly-buffered waters, and low levels of toxic substances. Moderate inputs of soluble salts increased macroinvertebrate abundance without significantly changing community structure or giving other indications of stressed conditions. Major problems were increased salinity, sedimentation, and water depletion. It was concluded that mining in the West may not have the severe impacts on stream biota which characterize many eastern mining regions. (See also W79-09235) (Chilton-ORNL)
W79-09245

MEIOFAUNAL ABUNDANCE IN SANDBARS OF ACID MINE POLLUTED, RECLAIMED, AND UNPOLLUTED STREAMS IN SOUTHEASTERN OHIO,
Ohio Univ., Athens. Dept. of Zoology.
W. D. Hummon, W. A. Evans, M. R. Hummon, F. G. Doherty, and R. H. Wainberg.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 188-203, 1978. 1 fig, 3 tab, 18 ref.

Descriptors: *Environmental effects, *Mining, Acid mine water, Wildlife, Aquatic life, Ohio, Water pollution, Streams, Sediments, Meiofauna, Abundance, Diversity.

Meiofaunal samples were collected at each of two sites along seven streams during a period of stable weather. Physical-chemical parameters measured at each of 14 sites included temperature, pH, conductivity, carbonate alkalinity, sulfates, calcium and total hardness, manganese, iron, dissolved oxygen, biochemical oxygen demand, and stream flow. The number of major taxa collected ranged from 3 to 11 with geometric mean abundance of total meiofauna/station ranging from 21 to 443 organisms/10 square cm of surface. Diptera, one of 16 taxa seen, total numbers of taxa present, and geometric means of total meiofauna were negatively correlated with values for compensated noncarbonate conductivity. Results of similarity analysis formed a pattern. Unpolluted streams along with several sites with a past history of mining showed H' diversity values of 1.6 to 2.8 with 40 to 80% in common. The remaining sites, all with a past history of mining, formed two groups. One group, dominated by rotifers, showed H' values of 1.2 to 1.6 with 36 to 52% in common while the other group, dominated by nematodes, showed H' values of 1.3 to 1.5 with 46% in common. (See also W79-09235) (Chilton-ORNL)
W79-09246

CYTOTOXICITY OF UNTREATED COAL-CONVERSION GASIFIER CONDENSATE,
Tennessee Univ., Oak Ridge. Graduate School of Biomedical Sciences.
T. W. Schultz, J. N. Dumont, and L. M. Kyte.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 204-218, 1978. 5 fig, 1 tab, 21 ref.

Descriptors: *Environmental effects, *Coals, Toxicity, Protozoa, Behavior, Respiration, Growth rates, Coal-conversion technology, Gasifier, Condensate, Cytology.

The behavior, respiration, cytology, and growth rates of Tetrahymena pyriformis exposed to varying concentrations of untreated laboratory-scale Synthane gasifier condensate were investigated. Little if any change in shape and motility were seen at concentrations of 1% but at 2% or greater decrease in motility and increase in cell lysis were observed. The condensate caused a nonlinear, dose-dependent reduction in oxygen consumption. At all concentrations there were cytological alterations in the mitochondrial matrixes, which became more electron dense. Cell membranes disrupted and mucocysts were discharged. Population growth was reduced by product water concentrations as low as 0.2% and completely inhibited at 1%. (See also W79-09235) (Chilton-ORNL)
W79-09247

AQUATIC TOXICOLOGY OF TRACE ELEMENTS OF COAL AND FLY ASH,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
W. J. Birge.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 219-240, 1978. 5 fig, 6 tab, 34 ref.

Descriptors: *Environmental effects, *Toxicology, *Trace elements, Coals, Fly ash, Aquatic life, Embryonic growth stage, Larval growth stage.

Aquatic bioassays were performed to establish a comparative toxicological ranking for 22 coal elements. Embryo-larval bioassays showed the high toxicity of many elements to aquatic biota. Depending on species, LC50 values of 0.1 ppm or less were found for 15 coal elements and calculated LC1's ranged down to 0.1 to 0.2 ppb for mercury and silver. Tungsten was the least toxic element. The increasing order of sensitivity of animal species was goldfish, trout, and toad. Order of toxicity of the elements varied somewhat for embryo-larval stages. Ag, Cd, Cr, Hg, Ni, and Pb were among the 12 most toxic for all three species and Al, As, Co, Cu, Ge, V, and Zn were included in the most toxic group for trout and goldfish. It was concluded that a substantial number of trace elements of coal and fly ash are highly toxic to aquatic organism. Many of these are leachable from ash residues at concentrations that prove lethal to fish and amphibian embryo-larval stages. (See also W79-09235) (Chilton-ORNL)
W79-09248

MERCURY CONTAMINATION STANDARDS FOR MARINE ENVIRONMENT,
Environmental Research Lab., Narragansett, RI.
R. Eisler.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 241-272, 1978. 2 tab, 296 ref.

Descriptors: *Environmental effects, *Mercury, Aquatic life, Water quality standards, Water pollution, Water quality, Standards.

This paper reviews the literature on mercury effects in saline waters and recommends criteria and research approaches for incorporating mercury contamination standards which would protect marine products of commerce, their food organisms and their predators. Specific recommendations include the prohibition of the sale, manufacture, and use of methyl mercury compounds; restriction of the use of other mercurials; development of alternative technologies; removal of mercury from contaminated waterways; development of monitoring criteria; refinement of chemical methods for the detection of mercury; and the application of recommendations to other contaminants. (See also W79-09235) (Chilton-ORNL)
W79-09249

A RADIOISOTOPIC STUDY OF MERCURY UPTAKE BY HUDSON RIVER BIOTA,
New York Univ. Medical Center, Tuxedo. A. J. Lanza Research Lab.
L. S. Zubarik, and J. M. O'Connor.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 273-289, 1978. 4 fig, 5 tab, 34 ref. NIEHS ES-00260.

Descriptors: *Environmental effects, *Path of pollutant, Mercury, Hudson River, Algae, Plankton, Absorption, Larvae, Temperature, Seasonal, Organic compounds.

A variety of Hudson River forage organisms, ranging from algae to fish larvae, accumulated mercury compounds from the test environment. Concentrations in organisms ranged from 100 to 1,000,000 times that in the test medium. Uptake occurred via food as well as directly from water. Greatest relative concentration occurred among algae and the least among larger planktonic crustacea and striped bass larvae. Experiments with Gammarus showed greater uptake of organic over inorganic forms of mercury but only after exposures of 1 week. Initial uptake of both forms was rapid. Uptake of all forms of mercury compounds increased during the summer months with increase of organic forms increasing to a greater extent than that of inorganic forms. Temperature change was found to be an important factor in the degree of uptake. (See also W79-09235) (Chilton-ORNL)
W79-09250

IMPACT OF ARSENICALS ON NITRIFICATION IN AQUEOUS SYSTEMS,

Southeast Environmental Research Lab., Athens, GA.
H. W. Holm, and M. F. Cox.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 290-300, 1978. 4 fig, 1 tab, 20 ref.

Descriptors: *Environmental effects, *Arsenic, *Nitrification, Bacteria, Nitrites, Ammonia.

The impact of arsenicals (at concentrations of 0, 0.1, 1, 10, 100, and 1000 mg As/l) on nitrification was determined by measuring the oxidation of ammonia and nitrite. At concentrations of 100 and 1000 mg As/1, arsenate decreased the rate of oxidation of ammonia by Nitrosomonas. Oxidation of nitrite to nitrate by Nitrobacter was delayed at concentrations of 0.1, 1, and 10 mg As/1 and concentrations of 100 and 1000 mg As/1 inhibited the process. At concentrations of 1000 mg As/1, the oxidation of ammonia by Nitrosomonas was delayed by cacodylic acid. Nitrobacter was not affected by cacodylic acid. (See also W79-09235) (Chilton-ORNN)
W79-09251

COPPER SENSITIVITY OF ADULT PACIFIC OYSTERS,
California Univ., Livermore. Lawrence Livermore Lab.
F. L. Harrison, and D. W. Rice, Jr.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 301-315, 1978. 2 fig, 3 tab, 34 ref. DOE W-7405-ENG-48 & NRC 60-76-144.

Descriptors: *Environmental effects, *Toxicity, Copper, Oysters, Absorption, Mortality.

Oysters were exposed to copper at concentrations ranging from 100 to 1300 microg/1 in a flow-through bioassay system. The family of mortality curves of time vs. copper concentration was difficult to interpret because increased copper concentrations did not consistently result in increased mortality rates. Correcting the duration of copper exposure by a factor related to the length of time that the shell was open produced more typical curves. At concentrations of 200 microg Cu/1 and higher, significant mortalities occurred. Data showed an LC50 at 48 hr of 650 microg/1, and LC50 at 96 hr of 430 microg/1, and an incipient LC50 of 230 microg/1. (See also W79-09235) (Chilton-ORNL)
W79-09252

AN IN SITU STUDY OF CADMIUM STRESS IN A NATURAL ZOOPLANKTON COMMUNITY,
Argonne National Lab., IL. Radiological and Environmental Research Div.
J. S. Marshall, and D. L. Mellinger.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 316-330, 1978. 2 fig, 3 tab, 38 ref.

Descriptors: *Environmental effects, Water pollution, Cadmium, Biological communities, Zooplankton, Toxicity.

Results of this study showed that added cadmium concentrations as low as 5 microg/1 caused significant effects on both functional and structural attributes of a Lake Michigan zooplankton community in 9 days but that the effects of enclosure were relatively minor up to 15 days. Significant differences in species' rates of increase were seen among Cladocera, Calanoida, and Cyclopoida but similar sensitivities were seen within each group. Results indicated that added cadmium concentrations less than 5 microg/1 probably would cause detectable effects within 9 days and that incubations up to 15 days are feasible. (See also W79-09235) (Chilton-ORNL)
W79-09253

THERMAL ECOLOGY AND STRESS: A CASE HISTORY FOR RED-SORE DISEASE IN LARGEMOUTH BASS,
Wake Forest Univ., Winston-Salem, NC. Dept. of Biology.
G. W. Esch, and T. C. Hazen.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 331-363, 1978. 18 fig, 1 tab, 40 ref.

Descriptors: *Environmental effects, *Stress, *Thermal stress, Fish diseases, Biological communities, Populations, Bass.

This paper describes the stress phenomenon in physiological terms and illustrates how it has application at the individual and ecosystem levels of organization. These relationships are represented by describing the case history of red-sore disease among largemouth bass in the southeastern U.S. Based on information of the distribution of largemouth bass and the bacterium which causes red-sore disease (Aeromonas hydrophila) and the fact that the disease has only been reported in the southeastern U.S., it was concluded that a unique assortment of physiochemical properties in a given aquatic system, an assemblage of susceptible hosts, and the presence of the bacterium would promote an epizootic outbreak of the disease. It is hypothesized that stress and its impact at individual, population, and ecosystem levels of organization would temper the potential for outbreak. (See also W79-09235) (Chilton-ORNL)
W79-09254

SIZE-FRACTIONATED PRIMARY PRODUCTIVITY IN LAKE MICHIGAN NEAR THE KEWAUNEE NUCLEAR POWER PLANT,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
S. I. Zeeman, and R. Grunewald.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 364-380, 1978. 1 fig, 4 tab, 36 ref.

Descriptors: *Environmental effects, *Powerplants, Cooling water, Primary productivity, Phytoplankton, Lake Michigan, Kewaunee Nuclear Power Plant, Populations.

Samples were collected from a precondenser station and a postcondenser station on eighteen dates. Productivity was determined for three size fractions by filtration through 64-, 10-, and 0.45 microm porosity filters. In the unfractionated samples, univariate analysis of variance indicated that there was no difference between pre and post condenser productivity rates. Multivariate analysis of variance applied to size-fractionated samples indicated that there were lower productivity rates only when a temperature rise occurred across the condenser. Average productivity rates during the period of the study at the postcondenser station were within 13% of those at the precondenser station. Chlorophyll a values were within 4% of precondenser values. It was concluded that phytoplankton populations suffer no damage in passage through the cooling system even though individuals may be killed. (See also W79-09235) (Chilton-ORNL)
W79-09255

PRIMARY PRODUCTIVITY: ANALYSIS OF VARIANCE IN A THERMALLY ENRICHED AQUATIC SYSTEM,
Rice Univ., Houston, TX.
M. O. Welch, and C. H. Ward.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 381-391, 1978. 5 fig, 21 ref.

Descriptors: *Environmental effects, *Thermal stress, *Water pollution, Aquatic life, Phytoplankton, Cooling water, Reservoir, Primary productivity, Temperature.

In situ investigation of primary productivity of heated and ambient surface waters, and enrichment response was made in a cooling reservoir of a 530 MW electric generating plant. Analysis of variance techniques showed that primary productivity was significantly increased at the heated station on 18 of the 26 sampling days. The magnitude of this difference was not correlated with difference in water temperature at the stations. Nutrient enrichment did not appear to have an effect on primary productivity. Temperature optimum for the natural community of phytoplankton was determined to be approximately 25C. The phytoplankton community exposed to higher temperature exhibited a higher tolerance range than did the community at ambient temperature. (See also W79-09235) (Chilton-ORNL)
W79-09256

NITRATE REDUCTASE ACTIVITY AND PRIMARY PRODUCTIVITY OF PHYTOPLANKTON ENTRAINED THROUGH A NUCLEAR POWER STATION ON NORTHEASTERN LONG ISLAND SOUND,
Connecticut Coll., New London. Dept. of Botany.
B. B. Peck, and R. S. Warren.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 392-409, 1978. 5 fig, 2 tab, 25 ref.

Descriptors: *Environmental effects, *Powerplants, Temperature, Chlorine, Primary productivity, Phytoplankton, Long Island Sound, Cooling water, Nitrate reductase activity.

Samples taken at the cooling water intake of a nuclear power plant during August showed ambient temperatures ranging from 19.5 to 20 C. During power generation, water temperatures showed an increase of 11 and 14 C at the discharge. Phytoplanktonic nitrate reductase activity was depressed by 88 to 89% and primary productivity by 42 to 52% during the 6- to 9-hr transit through the cooling pond. Nitrate reductase activity in phytoplankton which had been exposed to mean temperature increases of 13 C on seven days in August did not return to normal intake levels after 24-hr at ambient temperature. Ambient temperature at the intake during March and April ranged from 4.3 to 9.9 C. Temperature increase through the cooling system was 11.5 to 18.1 above ambient temperature. Phytoplanktonic reductase activity was stimulated 25% after 6- to 9-hr exposure to these conditions. Photosynthetic rate of entrained phytoplankton was reduced at chlorine concentrations above and below 0.50 ppm. At 1.0 and 1.2 ppm chlorine concentrations, nitrate reductase activity was decreased by 15%. (See also W79-09235) (Chilton-ORNL)
W79-09257

GROWTH OF DUCKWEED UNDER CONSTANT AND VARIABLE TEMPERATURES,
Savannah River Ecology Lab., Aiken, SC.
R. R. Sharitz, and J. C. Luvall.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 410-419, 1978. 1 fig, 1 tab, 29 ref.

Descriptors: *Environmental effects, *Temperature, *Thermal pollution, Powerplants, Aquatic weeds, Growth rates, Duckweed, Spirodela oligorrhiza.

Populations of Spirodela oligorrhiza were exposed to cyclic, acyclic and constant temperature regimes. Cyclic and acyclic regimes ranged from 10 to 25 C. The number of adult fronds, determined at weekly intervals, was used as a measure of population growth. In all populations, rate of growth was highest at 25 C. Cyclic and Acyclic regimes did not result in growth rates which were significantly different from those at constant temperature equal to the mean of the range. It was concluded that population growth of the duckweed was related to temperature at all regimes. (See also W79-09235) (Chilton-ORNL)
W79-09258

GROWTH AND ECOLOGY OF SPARTINA ALTERNIFLORA IN MAINE AFTER A REDUCTION IN THERMAL STRESS,
Maine Univ. at Orono. Dept. of Botany and Plant Pathology.

M. Keser, B. R. Larson, R. L. Vadas, and W. McCarthy.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 420-433, 1978. 5 fig, 1 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Thermal stress, Aquatic plants, Growth rates, Biomass, Density, Populations, Spartina alterniflora.

Relocation of surface thermal discharge through a diffuser system resulted in the termination of thermal stress to a population of Spartina alterniflora in Montsweag Bay, Maine. During the first year after diversion of the thermal discharge, no significant effect was observed in growth and recovery but during the following two years biomass and density increased slightly and shoot growth returned to prestress levels. Removal of a causeway in the area resulted in increased salinity, greater tidal amplitude and decreased summer temperatures. These factors contributed to a decline in biomass in relation to previous values. (See also W79-09235) (Chilton-ORNL)
W79-09259

EFFECTS OF REDUCED TEMPERATURES ON PREVIOUSLY STRESSED POPULATIONS OF AN INTERTIDAL ALGA,
Maine Univ. at Orono. Dept. of Botany and Plant Pathology.
R. L. Vadas, M. Keser, and B. Larson.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 434-451, 1978. 5 fig, 2 tab, 26 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Thermal stress, Temperature, Algae, Aquatic plants, Growth rates, Estuaries, Monitoring, Ascophyllum nodosum.

Reduced temperatures in an estuary near a nuclear power plant were brought about by relocation of surface thermal discharge through a diffuser and the removal of a causeway in the area. This reduction in temperature resulted in a return of populations of Ascophyllum nodosum populations to prestress levels. The reversal in Ascophyllum growth after elimination of thermal stress and changes in growth patterns caused by thermal alterations suggest that this species might be an effective candidate for monitoring stress in marine systems. (See also W79-09235) (Chilton-ORNL)
W79-09260

GENETIC AND PHYSIOLOGICAL FLEXIBILITY OF A CALANOID COPEPOD IN THERMAL STRESS,
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.
B. P. Bradley.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 452-469, 1978. 2 fig, 3 tab, 47 ref, 2 append. OWRT B-021-MD(2), NSF BMS-75-20282.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Copepods, Flexibility, Genetics, Animal physiology, Genetic flexibility, Physiological flexibility.

Temperature tolerances of individual copepods were measured as time to inactivity or to succomb to temperature shock. Results showed that Eurytemora populations vary considerably in genetic influence on temperature tolerance. Genes expressed themselves more clearly in males than in females. Most of the genetic variance appeared to be additive. Physiological variance was expressed more in females than in males. Field observations and laboratory experiments indicated that copepod populations in Chesapeake Bay are at or near their limit of survival in summer temperatures. It was concluded that the measures of physiological and genetic flexibility observed are not sufficient by themselves to predict the survival of Eurytemora in an even wider range of temperatures. (See also W79-09235) (Chilton-ORNL)
W79-09261

EFFECTS OF THERMAL EFFLUENTS ON REPRODUCTION IN A SEA ANEMONE,
California Univ., Berkeley. Dept. of Zoology.
B. L. Jennison.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 470-483, 1978. 6 fig, 1 tab, 13 ref.

Descriptors: *Environmental effects, *Temperature, Powerplants, Effluents, Reproduction, Aquatic animals, Adaptation, Anemones, Anthopleura elegantissima, Acclimation.

Reproduction of the sea anemone Anthopleura elegantissima was observed in the thermal outfall canal of a power plant and at a control site. Males from the thermal-outfall canal exhibited a delayed onset of gametogenesis but spawned as much as 1 month earlier than those in natural populations. Females in the outfall began gametogenesis at the same time as control animals but spawned earlier. Control females transplanted to the outfall underwent accelerated vitellogenesis and spawned 4 to 5 months ahead of either unmanipulated control or acclimated outfall anemones. Control anemones spawned during peak summer temperatures which may reach 15C while outfall anemones spawned after temperatures in the canal reached 25 C. It was concluded that outfall anemones have become acclimated to the warmer water. (See also W79-09235) (Chilton-ORNL)
W79-09262

A COMPARISON OF MORPHOMETRIC, BIOCHEMICAL, AND PHYSIOLOGICAL INDEXES OF CONDITION IN MARINE BIVALVE MOLLUSCS,
Woods Hole Oceanographic Institution, MA.
R. Mann.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 484-497, 1978. 2 tab, 54 ref. NOAA 04-6-158-44106.

Descriptors: *Environmental effects, *Temperature, Mollusks, Bioassay, Index of condition.

Laboratory and field data are used to determine the effect of temperature on gravimetric and volumetric meat/shell condition indexes; percentages of organic content, carbohydrate, carbon, and nitrogen; C/N and carbohydrate/N ratios; weight-specific ammonia excretion rates; and oxygen-consumption/ammonia-excretion ratios in several species of oyster, clam and mussel. Data indicated that volumetric or gravimetric assay of condition could be as meaningful as more complex biochemical assays. (See also W79-09235) (Chilton-ORNL)
W79-09263

RESPONSE OF MOSQUITOFISH TO THERMAL EFFLUENT,
Savannah River Ecology Lab., Aiken, SC.
D. H. Bennett, and C. P. Goodyear.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 498-510, 1978. 3 fig, 3 tab, 17 ref. DOE EY-76C-09-0819.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Reproduction, Size, Populations, Sexual maturity, Mosquitofish, Gambusia affinis, Body fat, Sex ratios.

Mosquitofish were sampled from three thermally affected stations (28 to 40C) and two unaffected stations (12 to 29C). The five populations were studied for reproductive activity, sex ratios, size at sexual maturity, percentage of fat, and size structure. Observations of reproductive activity showed that females with eyed embryos were found in populations from unaffected waters in June and in affected populations throughout the study period (February to December). Mean brood size of populations from thermally affected areas generally varied inversely with water temperature. Size at sexual maturity and sex ratios were similar in all populations. Body fat content varied seasonally with each population with percentages of fat being higher in males and juveniles from thermally affected waters. Mean size of females from unaffected areas was found to be directly related to water temperature but the size structure of populations from unaffected waters varied inversely with temperature. It was concluded that Gambusia affinis can adapt to severe thermal conditions. (See also W79-09235) (Chilton-ORNL)
W79-09264

RESPONSE OF A MOBILE INVERTEBRATE TO HETEROTHERMAL CONDITIONS,
Wisconsin Univ.-Madison. Lab. of Limnology.
S. J. Lozano, and J. F. Kitchell.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 511-521, 1978. 3 fig, 4 tab, 15 ref. OWRT A-070-WIS(4) and EPA R803971020.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Temperature, Cooling water, Amphipoda, Distribution patterns, Reproduction.

Hyalella azteca were collected from ten stations in a power plant cooling lake having a stable 15 C horizontal temperature gradient throughout the year. Seasonal temperatures ranged from 4 C at the cool end of the lake during winter to 45 C at the warm end in summer. Distribution and growth of H. azteca were restricted by the thermal characteristics of the lake. High summer temperatures excluded amphipods from 50% or more of the lake. Growth rate and duration of instar were accelerated by increased temperature but length frequency distributions showed greater growth at each instar at cooler temperatures. Reproduction occurred only during short time intervals in spring and fall as opposed to continuous summer reproduction in surrounding waters. It was concluded that amphipods respond to thermally altered conditions by altering their distribution. (See also W79-09235) (Chilton-ORNL)
W79-09265

TEMPERATURE SELECTION BY YOUNG TOPSMELT: LABORATORY AND FIELD INVESTIGATIONS,
Occidental Coll., Los Angeles, CA. Dept. of Biology.
K. F. Ehrlich, G. E. McGowen, and G. Muszynski.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 522-533, 1978. 3 fig, 2 tab, 25 ref.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Effluents, Fish, Fish behavior, Temperature, Distribution patterns, Topsmelt, Atherinops affinis.

The laboratory preferred-temperature range for Atherinops affinis during the period of 3 to 198 days post-hatching was determined to be 19 to 23 C. Temperatures warmer than 27 C were avoided by the topsmelt. The fish moved freely throughout the experimental chamber when it was at a uniform temperature but after the formation of a temperature gradient, the topsmelt became positioned in the compartment they initially selected. Selected temperatures were independent of acclimation temperatures. Shifting isotherms did not cause the fish to move until they contacted near lethal temperatures. The observed behavioral responses of topsmelt suggest that they may be attracted to warmed water but it does not imply that these conditions are necessarily beneficial to them. (See also W79-09235) (Chilton-ORNL)
W79-09266

MOVEMENT OF THREE SPECIES OF FISHES PAST A THERMALLY INFLUENCED AREA IN THE COOSA RIVER, ALABAMA,

Alabama Cooperative Fishery Unit, Auburn.
J. L. Moss, S. Boonyaratpalin, and W. L. Shelton.
In: Energy and Environmental Stress in Aquatic Systems. Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 534-545, 1978. 5 fig, 15 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Fish behavior, Fish passages, Fish barriers, Powerplants.

The objective of this study was to determine whether the cooling-water discharge from a coal-powered steam generating plant was an impassable barrier during warm months when thermal influence was maximum. Movement of ultrasonic-tagged largemouth bass and flathead and channel catfish passing the area was observed. Movement suggested that the fish avoided the area of maximum temperature by passing under or around it and that the heated water did not form an impassable barrier. (See also W79-09235) (Chilton-ORNL)
W79-09267

EFFECTS OF THERMAL EFFLUENT ON BENTHIC MARING INVETEBRATES DETERMINED FROM LONG-TERM SIMULATION STUDIES,
San Diego State Univ., CA. Center for Marine Studies.
R. F. Ford, D. G. Foreman, K. J. Grubbs, C. D. Kroll, and D. C. Watts.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 546-568, 1978. 1 fig, 5 tab, 23 ref.

Descriptors: *Environmental effects, *Thermal pollution, Effluents, Benthos, Growth rates, Mortality, Model studies.

The species studied in these simulation experiments on the effects of thermal effluents were the echinoid echinoderms Strongylocentrotus purpuratus and S. franciscanus, the asteroid echinoderms Pisaster ochraceus and P. giganteus, and the gastropod molluscs Astraea undosa, Kelletia kelletii, and Roperia poulsone. The sea urchin species showed low survival and impaired growth and condition in warmer temperatures with the effects being most pronounced among large adults. Growth and condition of the starfish were adversely affected by the effluents. K. kelletii and R. poulsoni were unaffected by the effluents. Growth and condition of A. undosa was adversely affected but survival was not affected. (See also W79-09235) (Chilton-ORNL)
W79-09268

EFFECTS OF THERMAL ALTERATION ON MACROINVERTEBRATE FAUNA IN THREE ARTIFICIAL CHANNELS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
D. E. Alston, J. M. Lawrence, D. R. Bayne, and F. F. Campbell.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 569-579, 1978. 1 fig, 2 tab, 19 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Invertebrates, Diptera, Oligochaetes, Density, Powerplants, Diversity.

During a 2-year study period, macroinvertebrates were collected at 4- to 6-week intervals from a control habitat receiving unheated water, a thermally stratified habitat receiving unheated and heated water, and a habitat receiving heated water only. Dominant organisms collected were oligochaetes and chironomid larvae. In dredge samples, overall mean diversities were not significantly different in the control habitat and the thermally stratified habitat but a lower diversity was found in the heated only water habitat. Plate samplers indicated highest diversity in the control habitat, intermediate diversity in the thermally stratified habitat and lowest diversity in the habitat receiving heated water only. More mayflies were present in the control and thermally stratified habitats. (See also W79-09235) (Chilton-ORNL)
W79-09269

EFFECTS OF POWER-PLANT OPERATION ON THE LITTORAL BENTHOS OF BELEWS LAKE, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. R. Lenat.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 580-596, 1978. 1 fig, 5 tab, 25 ref.

Descriptors: *Environmental effects, *Thermal pollution, Benthos, Powerplants, Lakes, Populations, Density, Biological communities, Thermal gradient, Biological gradient.

Populations of littoral benthos in a cooling reservoir of a power plant were studied over a three year period which included one preoperational year and two postoperational years. Approximately 150 taxa were recorded. Twenty-three of these were subjected to statistical analysis. It was found that changes in density for ten of these were associated with increases in temperature. Decreases in densities of Polypedilum digitifer, Nais communis, and Hyalella azteca were associated with increased temperature. Densities of Limnodrilus hoffmeisteri and Hexagenia munda increased with slight increases in temperature but declined at higher temperatures. Other taxa were indirectly affected by power-plant operation through changes in littoral macrophytes, periphyton, or other factors. Changes in community structure were assessed by the use of percent similarity coefficients. It was found that the imposition of a thermal gradient resulted in a corresponding biological gradient. (See also W79-09235) (Chilton-ORNL)
W79-09270

EFFECTS OF POWER-PLANT OPERATION ON THE PHYTOPLANKTON COMMUNITY OF BELEWS LAKE, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
P. H. Campbell.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 597-617, 1978. 3 fig, 3 tab, 34 ref.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Phytoplankton, Biological communities, Populations, Density, Lakes, North Carolina, Dominant organisms, Diversity.

The phytoplankton community in a cooling reservoir of a power plant was studied over a 4-year period which included two preoperational and two postoperational years. Comparison of surface water circulation patterns revealed an increase in spatial homogeneity of the phytoplankton after power-plant operation began. Although general successional changes in phytoplankton were observed after operation began, no major changes in standing crop were found. Chlorophyceae and Dinophyceae dominance increased while Bacillariophyceae dominance showed a decrease. Mean total cell densities and enrichment indexes decreased during the 4 year period and mean total biovolumes, numbers of taxa and Shannon-Weaver diversity indexes increased. (See also W79-09235) (Chilton-ORNL)
W79-09271

EFFECTS OF POWER-PLANT OPERATION ON THE ZOOPLANKTON COMMUNITY OF BELEWS LAKE, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
T. P. Anderson, and D. R. Lenat.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, Novenber 2-4, 1977. CONF-771114. p 618-641, 1978. 7 fig, 5 tab, 30 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Zooplankton, Biological communities, Populations, Powerplants, Density, Dominant organisms.

The zooplankton community in a cooling reservoir of a power plant was studied over a 3-year period which included one preoperational and two postoperational years. Probably the most notable influence of the power-plant operation on the zooplankton community of the lake was that the circulation of surface waters appeared to reduce station density differences and bring about a more similar seasonal density distribution for most taxa. Three species appeared to respond to power-plant operation. Hexarthra and Ptygura spp. increased in density and a winter increase in density of Polyarthra was also noted. Causes other than power-plant operation appeared to relate to other changes in the zooplankton community. (See also W79-09235) (Chilton-ORNL)
W79-09272

STOCHASTIC APPROACH TO PREDICT SURVIVAL OF ESTUARINE ANIMALS EXPOSED TO HOT DISCHARGE EFFLUENT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
K. S. Chung, and K. Strawn.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 642-662, 1978. 2 fig, 1 tab, 17 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Model studies, Powerplants, Cooling water, Crustaceans, Fish, Mortality, Forecasting, Estimating.

In the stochastic model used, aquatic animals were exposed to hot discharge effluent for 180 minutes. Temperature ranged from 7.2 to 30.5 C in the intake canal, from 19.4 to 41.6 C in the discharge canal above the cooling towers, and from 14.4 to 37.8 C below the towers. Seasonal mortality rates of 8 species of crustaceans and 46 fishes were estimated at several test temperatures for each of three seasons. During the hot season, mortality rates were 23% or more for most organisms at 40 C and 0 for most organisms at 35 C. In terms of average seasonal temperature, survival probabilities ranged from 0 to 96% from June-September and from 0 to 61% for the 56 species tested. Despite two weaknesses of the model (death rates were estimated from laboratory experiments rather than from field observations, and cumulative dosage and acclimation in the discharge canal afferent to the cooling towers were not considered), the model was accepted as adequately descriptive of seasonal survival of animals in the discharge-canal system. (See also W79-09235) (Chilton-ORNL)
W79-09273

PATHOGENIC SPECIES OF THERMOPHILIC AND THERMOTOLERANT FUNGI IN REACTOR EFFLUENTS OF THE SAVANNAH RIVER PLANT,
Indiana Univ., Bloomington. Dept. of Biology.
M. R. Tansey, and C. B. Fliermans.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium, Augusta, Georgia, November 2-4, 1977. CONF-771114. p 663-690, 1978. 2 fig, 4 tab, 17 ref. DOE AT(07-2)-1.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Powerplants, Cooling water, Fungi, Effluent, Savannah River Plant, Pathogenic fungi, Animal diseases.

Analysis of foam, water, microbial mats, plant debris, air, and soils from sites of elevated and ambient temperatures showed that except for Dactylaria gallopava, populations of thermotolerant and thermophilic fungi were not significantly different at elevated and ambient temperature sites. Dactylaria gallopava was directly associated with effluents having temperatures of 44 C or higher and was abundant in microbial mats, foam, and soils at the edges of cooling-water effluents. (See also W79-09235) (Chilton-ORNL)
W79-09274

RESPONSES OF THE ALLIGATOR TO INFECTION AND THERMAL STRESS,
Medical Univ. of South Carolina, Charleston. Dept. of Lab. Medicine.
A. B. Glassman, and C. E. Bennett.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 691-702, 1978. 6 fig, 11 ref. ERDA EY-76-S-09-0965.

Descriptors: *Environmental effects, *Thermal pollution, Thermal stress, Bacteria, Animal diseases, Reptiles, Alligator mississippiensis.

Peripheral blood components and serum protein electrophoretic patterns were studied in normal Alligator mississippiensis vs alligators infected by Aeromonas hydrophila and/or thermally stressed alligators. Thermal stress appeared to have a major effect on host response. Alligators maintained at 20, 25, 30, and 35 C had similar base-line levels of white blood cell counts. After infection their white blood cells and neutrophilic macrophages were maximum at 30 C (a temperature corresponding to optimum recovery of infected animals). Exposure to 35 C resulted in slightly lower neutrophilic macrophage numbers and death. It was concluded that A. mississippiensis is sensitive to bacteria when hert stressed. (See also W79-09235) (Chilton-ORNL)
W79-09275

ACCLIMATION STATES OF JUVENILE STRIPED BASS HELD IN CONSTANT AND FLUCTUATING TEMPERATURE REGIMES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
D. K. Cox.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 703-713, 1978. 3 fig, 2 tab, 19 ref. DOE W-7405-eng-26.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Striped bass, Juvenile fish, Acclimation state, Fluctuating temperature, Constant temperature.

Using young-of-the-year striped bass as test species and equilibrium loss at high temperatures as the measure of acclimation state, this study compares acclimation patterns developed in fish in fluctuating temperature with those developed in constant temperatures. Striped bass in this study exhibited acclimation states higher than the constant average temperatures but lower than the maximum temperatures of the cycle. Higher acclimation states were reached with more rapid cycling. Time of day and light did not appear to have any effect. It was concluded that tolerance data developed at constant acclimation temperatures will underestimate survival in fluctuating temperature regimes. (See also W79-09235) (Chilton-ORNL)
W79-09276

EFFECTS OF ACUTE AND CHRONIC THERMAL EXPOSURES ON THE EGGS OF THREE HUDSON RIVER ANADROMOUS FISHES,
Ecological Analysts, Inc., Middletown, NY.
E. L. Kellogg, J. J. Salerno, and D. L. Latimer.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 714-725, 1978. 3 tab, 12 ref.

Descriptors: *Environmental effects, *Thermal pollution, Thermal stress, Temperature, Powerplants, Embryonic growth stage, Fish, Striped bass, Alewife, Atlantic tomcod.

In order to assess the thermal impact of Hudson River power plants, Atlantic tomcod, alewife, and striped bass eggs were tested for chronic and acute tolerance to elevated temperatures. Results showed that upper lethal temperatures for normal hatching success were 26.5 C for alewife eggs, 26.3 C for striped bass eggs, and 6.6 C for Atlantic tomcod eggs. As the stage of embryonic development advanced, thermal tolerance of eggs exposed for 5 to 60 minutes increased. As duration of exposure increased, thermal tolerance of eggs decreased. (See also W79-09235) (Chilton-ORNL)
W79-09277

MULTIPLE-FACTOR AND SYNERGISTIC STRESSES IN AQUATIC SYSTEMS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
F. J. Vernberg.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 726-747, 1978. 5 fig, 73 ref.

Descriptors: *Environmental effects, Stress, Aquatic environment, Aquatic life, Multiple-factor stresses, Synergism.

This paper reviews recent research efforts dealing with the influence of multiple factors on organisms in aquatic systems. It emphasises recent literature which illustrates some distinct research areas and discusses problems which discourage multiple-factor studies. These problems include technological limitations of equipment to control and selectively vary a number of factors and the underdeveloped state of the statistical and computer methodology necessary to handle complex data. (See also W79-09235) (Chilton-ORNL)
W79-09278

ORDINATION OF MACROINVERTEBRATE COMMUNITIES IN A MULTISTRESSED RIVER SYSTEM,
Cincinnati Univ., OH. Dept. of Biological Sciences.
D. C. Beckett.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 748-770, 1978. 5 fig, 4 tab, 41 ref.

Descriptors: *Environmental effects, *Water pollution, Stress, Invertebrates, Biological communities, Rivers, Flow, Multiple-factor stresses, Ordination.

Fourteen stations over three time periods were used to investigate changes in biotic composition on a longitudinal and a temporal basis. Modifications in the pattern of relationships between communities owing to changes in river discharge and other physical-chemical parameters were also studied. Based on similarity indices, the stations showed patterns of affiliation which correlated with changes in river discharge. During periods of relatively high river discharge, a high degree of faunal similarity was seen between far upstream and far downstream stations. During low flow conditions, pollutional influences caused a biotic homogeneity among all downstream stations. During high river discharge periods, ordination of stations did not produce an ordering along any gradients but, under low flow conditions, stations ordered well along a gradient of pollutional disturbances. (See also W79-09235) (Chilton-ORNL)
W79-09279

LONGITUDINAL VARIATION IN THE MACROINVERTEBRATE FAUNA AND WATER CHEMISTRY OF AN EASTERN PENNSYLVANIA TROUT STREAM,
Lehigh Univ., Bethlehem, PA. Dept. of Biology.
P. T. Bradt.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 771-784, 1978. 2 fig, 2 tab, 36 ref.

Descriptors: *Environmental effects, *Water pollution, Water quality, Water chemistry, Invertebrates, Benthos, Urbanization, Pennsylvania, Brown trout.

Over a period of 17 months temperature, pH, total alkalinity, conductivity, orthophosphate, nitrate, chloride, and total iron were measured at eight stations on Bushkill Creek and benthos were sampled at four stations. Longitudinal variation was noted in both the water chemistry and in benthos. All chemical parameters increased downstream. Biomass, total numbers and number of taxa decreased at the downstream station which was located in an urban area. Dominant organisms changed from Stenonema at the upstream station to Hydropsyche at the two midstream stations to Chironomidae at the downstream station. It was concluded that stresses on the stream from urbanization must be minimized if the stream is to continue supporting a reproducing brown trout population. (See also W79-09235) (Chilton-ORNL)
W79-09280

THE EFFECT OF IONIZING RADIATION ON THE THERMAL TOLERANCE OF MOSQUITOFISH,
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. G. Blaylock, and M. L. Frank.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 785-793, 1978. 2 tab, 17 ref.

Descriptors: *Environmental effects, *Thermal stress, Resistance, Radiation, Fish, Thermal tolerance, Mosquitofish.

Gambusia affinis were exposed to doses of radiation ranging from 500 to 5000 rads from a Co60 source. Results of CTM type tests showed that only at 1500 rads and day 15 after irradiation was the value significantly different from the controls. Greatest range of individual CTM values (38.1 to 40.6 C) was also found at this dose and time. Tissues of Gambusia irradiated with 500 and 1500 rads were examined for pathological changes at 5, 15, and 30 days after irradiation. At 1500 rads after 5 days, atrophy of the hematopoietic tissues and gonads were observed. At 1500 rads, mean survival time was significantly different at day 5 and at day 15. Recovery had taken place by day 30. (See also W79-09235) (Chilton-ORNL)
W79-09281

RESPONSES OF ICHTHYOPLANKTON TO STRESSES SIMULATING PASSAGE THROUGH A POWER-PLANT CONDENSER TUBE,
New York Univ., Medical Center, Tuxedo. Inst. of Environmental Medicine.
G. V. Poje, T. C. Ginn, and J. M. O'Connor.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 794-808, 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Environmental effects, *Model studies, Larvae, Striped bass, Carp, Temperature, Flow, Biocides, Pressure, Powerplants, Simulator, Multiple factor stresses, Condenser tubes.

Carp and striped bass larvae were exposed for 5 min total to a variety of stresses in a power-plant condenser-tube simulator. Three sets of experimental conditions were used: (1) temperature was varied while a flow velocity of 1.22 m/sec and minimum pressure of 0.51 atm was maintained; (2) flow was varied while a constant, sublethal temperature increase (rise of 0 and 8.2 C for bass and 16.7 C for carp) was maintained; and (3) biocide concentrations were varied at constant velocity and temperature changes. Due to combined stresses, the survival pattern which developed was complicated. Carp larvae exhibited significantly higher latent mortalities at temperature changes of 18.1 C while striped bass were most sensitive at changes of 15.5 C. (See also W79-09235) (Chilton-ORNL)
W79-09282

EFFECTS OF SIMULATED ENTRAINMENT ON THE BIOLOGY OF A FRESHWATER CLADOCERAN,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. L. Buikema, Jr., S. R. Sherberger, G. W. Knauer, L. A. Newbern, and J. T. Reading.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-

771114. p 809-825, 1978. 2 fig, 6 tab, 37 ref.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Powerplants, Freshwater, Daphnia, Crustaceans, Chlorine, Temperature, Combined stresses, Multiple factor stress.

In a 12-min period, Daphnia pulex were exposed separately and in combination to temperature, chlorine, and mechanical stresses under simulated entrainment conditions. Mechanical stress had the greatest effect on survival. Temperature was the second most important parameter affecting cladoceran biology. A 14 C stress significantly reduced oxygen consumption and 10 to 14 C stresses reduced filtering rates. Thermal stress did not affect growth, molting or reproduction when food was abundant. Poor food quality caused a significant reduction in the number and vitality of young produced by females exposed to 10 C stress or to combined stress. ATP levels were reduced by chlorine and combined stress. (See also W79-09235) (Chilton-ORNL)
W79-09283

THE AVOIDANCE RESPONSE OF THE COMMON SHINER TO TOTAL AND COMBINED RESIDUAL CHLORINE IN THERMALLY INFLUENCED DISCHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, S. R. Larrick, J. D. Giattina, K. L. Dickson, and J. Cairns, Jr.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 826-837, 1978. 2 fig, 2 tab, 22 ref.

Descriptors: *Environmental effects, *Thermal stress, *Chlorine, Fish, Fish behavior, Powerplants.

Chlorine avoidances of the common shiner were evaluated by treating river water with doubling increments of total residual chlorine (TRC) from 0.025 to 0.40 mg/l. Depending on the acclimation temperature tested, the first threshold avoidance to TRC occurred at levels varying from 0.10 to 0.20 mg/l. Combine residual chlorine (CRC) and free residual chlorine (FRC) at this level varied from 0.077 to 0.159 and 0.035 to 0.122 mg/l respectively. Variation in threshold avoidance concentrations for fractions within the TRC was lowest for HOCl. In chloramine trials conducted at 12 and 24 C, avoidances first occurred at 0.207 and 0.205 mg/l, respectively. Fish acclimated at 12 and 24 C and tested at 17.6 and 26.8 C, respectively, showed threshold avoidances at 0.211 and 0.209 mg/l. At 12 and 24 C, chloramine avoidance thresholds were 0.399 and 0.195 mg/l, respectively. It was concluded that the common shiner is less influenced by chloramine and more sensitive to a low threshold of HOCl in TRC treatments. (See also W79-09235) (Chilton-ORNL)
W79-09284

WATER POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09320

5D. Waste Treatment Processes

PRESENT AND FUTURE WATER POLLUTION CONTROL PROJECTS IN JAPANESE RIVERS AND LAKES,
Ministry of Construction, Tokyo (Japan). River Improvement Div.
For primary bibliographic entry see Field 5C.
W79-09115

AN OVERVIEW OF BOTTOM SEDIMENT PROBLEMS IN SAGINAW RIVER AND BAY, MARINETTE-MENOMINEE HARBOR, AND WAUKEGAN HARBOR,
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5A.
W79-09125

5E. Ultimate Disposal Of Wastes

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME I: DISCUSSION,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
R. A. Jones, and G. F. Lee.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-45, Vol. I, August 1978. 208 p, 15 tab, 12 fig, 1 append, 90 ref.

Descriptors: *Environmental effects, *Wastes, *Dredged material, *Dredged material disposal, *Elutriate tests, *Open water disposal.

The elutriate test was developed to predict release of chemical contaminants from dredged sediments upon open-water disposal. This study evaluates factors influencing results of the elutriate test and its reliability in predicting release of contaminants during dredged material disposal operations. Sediment samples were taken from various waterways in the U.S. These samples were subjected to the standard and modified elutriate test to examine the influence of various factors on the test results. Field studies were also conducted at various locations and comparisons were made of the results of the standard and modified elutriate tests and water column concentrations during disposal operations. These studies showed the standard elutriate test, involving 30-minute mixing and one-hour settling, is a reliable test for predicting the potential release of contaminants associated with hydraulically dredged sediments dumped in open water. The standard tests should be conducted with compressed air. Air bubbles, in addition to mixing the solution, also keep the system oxic, thus simulating the conditions of importance for water column organisms at the dredged material disposal site. The elutriate test should continue to be used to evaluate potential release of contaminants at a dredged material disposal site involving open-water dumping or discharge of sediments. (See also W79-09086) (WES)
W79-09085

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME II: DATA REPORT,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
G. F. Lee, R. A. Jones, F. Y. Saleh, G. M. Mariani, and D. H. Homer.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A061 710, Price codes: A99 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-45, August 1978, (1 volume in 2). 1234 p, 526 tab, 192 fig, 1 append, 39 ref.

Descriptors: *Environmental effects, *Wastes, *Dredged material, *Dredged material disposal, *Elutriate test, *Open water disposal.

The elutriate test was developed to predict release of chemical contaminants from dredged sediments upon open-water disposal. This study evaluates factors influencing results of the elutriate test and its reliability in predicting release of contaminants during dredged material disposal operations. Sediment samples were taken from various waterways in the U.S. These samples were subjected to the standard and modified elutriate test to examine the influence of various factors on the test results. Field studies were also conducted at various locations and comparisons were made of the results of the standard and modified elutriate tests and water column concentrations during disposal operations. These studies showed the standard elutriate test, involving 30-minute mixing and one-hour settling, is a reliable test for predicting the potential release of contaminants associated with hydraulically dredged sediments dumped in open water. The standard tests should be conducted with compressed air. Air bubbles, in addition to mixing the solution, also keep the system oxic, thus simulating the conditions of importance for water column organisms at the dredged material disposal site. The elutriate test should continue to be used to evaluate potential release of contaminants at a dredged material disposal site involving open-water dumping or discharge of sediments. (See also W79-09085) (WES)
W79-09086

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, WINDMILL POINT MARSH DEVELOPMENT SITE, JAMES RIVER, VIRGINIA; SUMMARY REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. D. Lunz, T. W. Zeigler, R. T. Huffman, R. J. Diaz, and E. J. Clairain.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A066 224, Price codes: A07 in paper copy, A01 in microfiche. Technical Report D-77-23, August 1978. 116 p, 25 fig, 19 tab, 33 ref.

Descriptors: *Habitats, *On-site investigations, *Dredged material, *Habitat development, *Marsh development, *James River(VA).

A marsh habitat was developed using fine-textured inorganically and organically enriched sediments dredged from the James River navigation channel in winter of 1974-75. From autumn 1974 to September 1977, engineering and ecological activities documented marsh construction operations and environmental alterations that accompanied the marsh habitat development. The hydraulic construction of an inexpensive sand dike on a soft river bottom foundation and the ability of the dike to contain fine-grained hydraulically dredged sediments were demonstrated. Ecological monitoring and experimental studies of plants, soils, sediment and water quality; fish, aquatic invertebrate, and wildlife communities; and metals and chlorinated hydrocarbon compound uptake by marsh plants were also conducted. The ecological studies contrasted preconstruction and postconstruction conditions and compared postconstruction conditions with natural marsh habitat. The freshwater intertidal, semi-contained and upland dredged material substrate was nearly covered with over 75 types of naturally invaded plants within 6 months following construction. Channel sediments were slightly modified by the disposal operation. Natural reference marsh substrate characteristics more closely resembled original channel sediments than modified channel sediments forming the experimental marsh substrate. Two years following construction, apparent chemical equilibrium had developed, and tidal chemical conditions at the natural and experimental marshes were similar. (WES)
W79-09087

ANNOTATED TABLES OF VEGETATION GROWING ON DREDGED MATERIAL THROUGHOUT THE UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. C. Landin.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A068 459, Price codes: A08 in paper copy, A01 in microfiche. Miscellaneous Paper D-78-7, December 1978. 155 p, 6 tab, 48 ref.

Descriptors: *Vegetation establishment, *Vegetation, *Dredged material, *Waste disposal sites.

Presents data collected on the vegetation of dredged material islands and sites in Corps of Engineer-maintained waterways throughout the United States. More than 2000 dredged material islands and numerous dredged material sites have been built in the past 100 years; 202 of these were intensively sampled and all vegetation recorded, identified, and/or collected as voucher specimens. Six tables present: a. An anotated listing by

common name of 1120 plant species occurring on dredged material. b. A selection of 361 upland and high marsh plant species and 115 wetland plant species that may be planted on dredged material for wildlife habitat enhancement and/or substrate stabilization. c. Matrixes of the 361 upland and the 115 wetland plant species. d. An alphabetical group listing by scientific name and authority of the 1120 plant species occurring on dredged material. These data were prepared to provide managers with data for planned plant establishment on wetland and upland dredged material islands and sites throughout the United States. (WES)
W79-09088

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, MILLER SANDS MARSH AND UPLAND HABITAT DEVELOPMENT SITE, COLUMBIA RIVER, OREGON; APPENDIX E: POSTPROPAGATION ASSESSMENT OF BOTANICAL AND SOIL RESOURCES ON DREDGED MATERIAL,
Washington State Univ., Pullman.
P. E. Heilman, D. M. Greer, S. E. Brauen, and A. S. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 261, Price codes: A17 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-38, App. E, August 1978. 393 p, 52 fig, 118 tab, 1 append, 38 ref.

Descriptors: *Marshes, *Marsh plants, *Vegetation establishment, *Soil analysis, *Columbia River, *Dredged material, *Habitat development, *Waste disposal site.

Describes the study area, methods, and results of habitat development experiments conducted at Miller Sands, a dredged material disposal site near the mouth of the Columbia River. Consists of investigations and experimental plantings on the older upland portion of the island and on the more recently constructed spit and marsh area. Soil analyses showed relatively uniform soil conditions with sand texture on both experimental sites. Soil samples taken in the marsh in September 1976 after the first season's growth of propagated plants and the first application of the split fertilizer treatments showed significantly increased levels of ammonium and potassium and a reduction in soil pH corresponding to treatment rates. Available phosphorus determined by the oxalate method of extraction was not related to fertilizer treatment. Samples taken in June 1977 showed some increases in fertility probably as a result of the second fertilizer treatment on the split application plots, but, by August 1977, fertility levels had declined and showed little relationship to fertilizer treatment. A significant reduction in available N and exchangeable K due to uptake by plants was noted on the transplant plots, especially in the 1977 samples. (WES)
W79-09089

PREDICTING AND MONITORING DREDGED MATERIAL MOVEMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
B. W. Holliday, B. H. Johnson, and W. A. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 878, Price codes: A03 in paper copy, A01 in microfiche. Technical Report DS-78-3, December 1978. 44 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Sediment transport, *Monitoring, *Forecasting, *Dredged material, *Dredged material disposal, Waste disposal sites.

Summarizes results from three work units (1B06, 1B07, and 1B09) of the Dredged Material Research Program, concerned with predicting and monitoring dredged material movement. Work Units 1B06 and 1B09 concerned predicting the short-term fate of dredged material discharged in open water. 1B06 was an evaluation and calibration of the Tetra Tech disposal models (developed under Work Unit 1B02 of the DMRP by Tetra Tech, Inc.) using field data collected at several disposal sites, including the Duwamish, New York Bight, and Lake Ontario sites. This field data was collected under Work Unit 1B09 by Yale University. Work Unit 1B07 evaluated two two-dimensional finite element models (developed under Work Unit 1B05 of the DMRP by the University of California at Davis) for the long-term prediction of sediment transport in estuaries. Part II of the report discusses the modifications of the Tetra Tech models made by the U.S. Army Engineer Waterways Experiment Station and presents calibration results using field data from the Duwamish, New York Bight, and Lake Ontario disposal sites. Part III of the report discusses the factors in the long-term transport of sediment in estuaries and how they are handled by finite element models. (WES)
W79-09090

EVALUATION OF LAWS AND REGULATIONS IMPACTING THE LAND USE OF DREDGED MATERIAL CONTAINMENT AREAS,
Science Applications Inc., La Jolla, CA. Environmental Science Div.
J. Cole, and M. Brainard.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 905, Price codes: A13 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-55, September 1978. 265 p, 9 append, 2 tab, 31 ref.

Descriptors: *Land use, *Regulation, *Containment areas, *Dredged material, *Dredged material disposal.

Investigates laws and regulations of Federal, state, or local origin that encourage or discourage productive end uses of new land created by the confined disposal of dredged material produced by navigation channel improvement projects. A search was made for all Federal laws and regulations and the laws of 16 states where most confined disposal activities are taking place. Charters and regulations issued by the port districts or port authorities in the 16 states were also reviewed. All laws and regulations found that could have impact on land use decisions, including procedures for preparation and review of environmental impact assessments, are summarized. The most restrictive provisions were incorporated into scenarios for the application of permits to make productive uses of filled dredged material containment areas, and these were analyzed to develop strategies to overcome legal constraints on end use of this land. All provisions in the law promoting productive uses of land created by dredge-fill operations are summarized and used in structuring viable strategies for overcoming constraints noted in other jurisdictions. Conclusions and recommendations include approaches to the incorporation of a dredged material containment area 'location and end use' element in Level A, B, and C plans for river basins. (WES)
W79-09091

DENSIFICATION, TREATMENT, AND MANAGEMENT OF DREDGED MATERIAL DISPOSAL AREAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
C. C. Calhoun, Jr.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 273-289, 1978. 5 fig, 17 ref.

Descriptors: *Dredging, *Waste disposal, *Sediments, Soils, Soil disposal fields, Soil moisture, Soil properties, Surface water, Waste treatment, Flocculation, Polychlorinated biphenyls.

Work within the Disposal Operations Project of the Dredged Material Research Program related to the densification and treatment of dredged material and the management of containment areas is described. The process of dewatering/densifying dredged material through progressive trenching is discussed and the results of a major field test are given. Results of laboratory and field tests on the treatment of contaminated dredged material with chemical flocculants are presented. An integrated management approach for containment areas is presented through a generalized decision network. (See also W79-09113) (Deal-EIS)
W79-09130

THE RIVER DEE REGULATION SCHEME: OPERATIONAL EXPERIENCE OF ON-LINE HYDROLOGICAL SIMULATION,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
A. O. Lambert.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 29 p, 7 fig, 1 tab, 3 ref, 2 append.

Descriptors: *River regulation, *Real time, *Flood forecasting, *Mathematical models, *Telemetry, *River Dee(North Wales-UK), Low flow, Computers, Control, Simulation analysis, Hydrometric data, On-line, Management data, Costs, Benefits, Projects, Systems analysis.

In 1966, the River Dee was selected as a natural testing area for the development of new methods of hydrological modeling, real-time prediction and control, together with associated instrumentation and telemetry systems. This paper considers the implementation and use of models, including logistics, costs and benefits of operating high capital cost installations. Emphasized is the experience gained on the logistics of real-time hydrologic modeling, the choice of model structure and its fundamental effect on data input requirements, the relative importance of measured and forecast rainfall, and other similar matters. As a result of the Dee Research Project, the Welsh Water Authority now enjoys the benefits of a sophisticated telemetry system, with on-line hydrological simulation and forecasting capability, to assist in their multipurpose management of the River Dee System. Operational experience has shown that it is advantageous to use relatively simple hydrological models for on-line forecasting. (See also W79-09285) (Bell-Graf--Cornell)
W79-09293

5G. Water Quality Control

THE TOXIC SUBSTANCES CONTROL ACT (TSCA): HOW IT AFFECTS EPA FROM A RESEARCH AND ENFORCEMENT STANDPOINT,
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
For primary bibliographic entry see Field 5C.
W79-09122

WESTERN WATER LAW AND IRRIGATION RETURN FLOW,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 6E.
W79-09172

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W79-09180

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE, PROCEEDINGS, 1978 CORNELL AGRICULTURAL WASTE MANAGEMENT CONFERENCE.
Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1979. 740 p.

Descriptors: *Model studies, Conferences, Water quality control, Water pollution control, Water quality act, Federal water pollution control act, Conservation, Wastes, *Nonpoint sources, *Farm practices, Farm management, *Forest practices, Forest management, *Silviculture.

The papers presented at the 1978 Cornell Agricultural Waste Management Conference were grouped into the following catagories and published: Governmental aspects; Approaches for Best Management Practice (BMP) selection; Nutrient management; Silviculture; Economic, policy and institutional aspects; State and watershed approaches; and Modeling Studies. The emphasis for control of nonpoint pollution sources was placed upon the use of BMP's rather than on the collection, treatment and effluent standards approach used for control of point sources. (See W79-09186 thru W79-09230) (Skogerboe-Colorado State)
W79-09185

IMPROVING WATER QUALITY IN AGRICULTURE AND SILVICULTURE,
Department of Agriculture, Washington, DC.
D. G. Unger.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 11-16, 1979.

Descriptors: *Water quality control, *Water pollution control, Water law, Water management(Applied), Programs, Federal water pollution control act, Federal project policy.

This paper reports the viewpoints of U.S. Department of Agriculture on America's water quality needs and the programs designed to meet them. It was stressed that the overall job of upgrading water quality requires an effective combination of good management, technical assistance, economic incentives, research and education. (See also W79-09185) (Skogerboe-Colorado State)
W79-09187

A STATE PERSPECTIVE ON NONPOINT SOURCE MANAGEMENT,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5B.
W79-09188

RESEARCH NEEDS AND CURRENT ACTIVITIES,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
T. A. Murphy.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 25-30, 1979.

Descriptors: Water quality control, Water management(Applied), Soil conservation, *Water conservation, Management, Federal project policy, Mathematical models, Environmental control, *Agricultural research, *Research priorities.

This paper focused on broad topics regarding the renewable resources industry, including the current concerns, issues, and emerging environmental problems. The role of EPA in agricultural research was discussed in terms of both the nature and extent of activities, within the context of cooperation with the agribusiness community. Reliance on typical soil and water conservation measures as best management practices for maintenance of water quality was viewed from the perspective of present technical knowledge and system assessment capabilities. Additional studies necessary to confirm the link between water quality and best management practices were suggested. It was suggested that improved monitoring techniques, in-stream water quality surveys, and a better understanding of sediment/pollutant adsorption and desorption mechanisms are required in the near future to sharpen the guidelines for establishing agricultural nonpoint source management systems. Needed area-wide pollution problem assessment methodologies, BMP field evaluation, mathematical modeling of transport phenomena, and predictive techniques for BMP system comparisons were outlined. The projected extent of EPA/ORD involvement in these future activities was examined in light of potential resource availability and was compared with similar activities in other Federal, State, and local agencies and institutions. (See also W79-09185) (Skogerboe-Colorado State)
W79-09189

THE ROLE OF CONSERVATION PRACTICES AS BEST MANAGEMENT PRACTICES,
Soil Conservation Service, Washington, DC.
J. S. Johnson.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 69-78, 1979. 16 ref.

Descriptors: *Water pollution control, Water quality control, Water quality act, Soil conservation, Management, Water pollution sources, Irrigation, Water conservation, *Farm practices, Nonpoint sources.

The combination of conservation practices selected to meet the needs of a particular land and water problem and achieve the desired results was viewed as a resource management system. Experience and research have shown that many resource management systems are highly effective in protecting and improving water quality. The resource management system selected may include agronomic, managerial, and structural practices that reduce nonpoint source pollution and protect water quality. The best resource management system is one that keeps the water where it falls, protects the resource base, and maintains water quality of the water that runs off. It was suggested that such proved resource management systems can be used in achieving national goals of improved water quality, and because of the recognized effectiveness of conservation practices and resource management systems in controlling nonpoint source pollution, many of them can be selected and listed as BMP in Section 208 Water Quality Management plans. (See also W79-09185) (Skogerboe-Colorado State)
W79-09192

RELATIONSHIPS BETWEEN AGRICULTURAL LAND AND WATER QUALITY,
Department of Agriculture, Ottawa (Ontario). Central Experimental Farm.
D. R. Coote, E. M. MacDonald, and R. DeHaan.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 79-92, 1979. 5 tab, 11 ref.

Descriptors: *Land use, *Agricultural watersheds, Agricultural chemicals, Statistical methods, Great Lakes, Regression analysis.

The study described in this paper was developed as an adjacent to the Pilot Watershed Studies of the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG) of the International Joint Commission (IJC) with the objective of determining the relationships among water quality, pollutant loadings and land use data gathered in watersheds representative of different agricultural areas. The approach taken was to: (1) identify and survey a number of purely agricultural watersheds (nonagricultural land use essentially absent) representative of different agricultural systems in the Canadian Great Lake Basin; (2) monitor the water quality at the watershed outlet; and (3) examine statistical relationships between the characteristics of these watersheds and the water quality observed at their outlets. A further objective of the study was to provide a basis for predictions of water quality in unmonitored agricultural areas of the Canadian Great Lakes Basin. (See also W79-09185) (Skogerboe-Colorado State)
W79-09193

INTEGRATING WATER QUALITY AND BEST MANAGEMENT PRACTICES,
New York State Assembly Research Staff, Albany.
A. F. Taverni, and R. F. Dworsky.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 93-115, 1979. 4 fig, 6 tab, 15 ref.

Descriptors: *Water quality control, Water pollution control, Water quality act, Planning, Management, Hudson River, Salinity, *Farm practices.

This paper discussed in detail the New York State Level B plans (section 209 of Public Law 92-500) which contribute to improved water quality through the use of common techniques. Specifically, this paper focused on the Genesee River, Hudson River and Lake Champlain. It provided a summary of Best Management Practices and the relation of Best Management Practices to overall water quality management. Lastly, this paper demonstrated the viability of a state integrated planning approach. (See also W79-09185) (Skogerboe-Colorado State)
W79-09194

ENVIRONMENTAL IMPLICATIONS OF TRENDS IN AGRICULTURE AND SILVICULTURE,
Development Planning and Research Associates, Inc., Manhattan, KS.
S. G. Unger.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 117-131, 1979. 1 fig, 2 tab.

Descriptors: Environmental sanitation, Pollutant identification, *Water pollution sources, Water quality control, Agriculture, Pasture management, Range management, *Forest management, Environmental control, Pollution abatement, *Farm management.

In a study sponsored by the Environmental Protection Agency (EPA) the environmental implications of production-related trends were assessed in the following five sub-sectors: Agriculture--(1) Nonirrigated crop production, (2) Irrigated crop production, (3) Livestock feedlot production, (4) Range and pasture management, and, Silviculture--(5) Silviculture and harvest management. The period of analysis was 1976-2010, and the emphasis was on the long-term future under moderate growth assumptions. This presentation summarized the findings of the EPA study including the ratings and rankings--by a national evaluation workshop--of environmentally-related trends within each of the five subsectors. Also, a further analysis of the various types of trends within the crop production subsectors was made to determine the relative importance of management practices--compared to input-use restraints and residual-output treatments--within the crop production system as a potential means of environmental pollution control in the future. (See also W79-09185) (Skogerboe-Colorado State)
W79-09195

BEST MANAGEMENT PRACTICES FOR FERTILIZER USE,
Fertilizer Inst., Washington, DC.
W. C. White, and H. Plate.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 133-141, 1979. 3 tab, 9 ref.

Descriptors: *Nutrient removal, Nutrient requirements, *Fertilizers, Environmental sanitation, Management, Application methods, Timing, Water quality control, *Farm practices.

A few examples were presented to illustrate the wide range of factors to consider in controlling nutrient levels in soils as to maximize plant recovery and to minimize loss to the environment. Even with the best available matrix mathematics, all individual factors cannot be quantitatively evaluated for every single eventual possible field condition. The judgement of the farmer must come into play in exercising Best Management Practices (BMP's) for nutrient use in crop production. It was suggested that the following four BMP's for plant-nutrient use deserve special attention: (1) matching rate of application closely to the need of each soil-crop combination, (2) time of fertilizer application, (3) method of application, and (4) forms of nutrients relative to crop recovery and loss to the

environment. (See also W79-09185) (Skogerboe-Colorado State)
W79-09196

BEST MANAGEMENT PRACTICES FOR SILVICULTURE,
Weyerhaeuser Co., Tacoma, WA.
W. C. Harper.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 263-270, 1979.

Descriptors: Forest management, Forest watersheds, Water quality control, Water pollution control, Water quality act, Pollution abatement, *Forest practices.

The silvicultural aspects related to Section 208 planning of Public Law 92-500 were addressed to ensure that the resulting plan is compatible with long-term forest management objectives. It was suggested that alternative management practices are developed for each site to allow land managers to select among an appropriate range of acceptable management practices. It was also suggested that an assessment of the effectiveness of Best Management Practices in meeting land management goals, including both water quality and timber production, must be conducted following implementation of the 208 plan. (See also W79-09185) (Skogerboe-Colorado State)
W79-09203

ESTIMATING IMPACTS OF SILVICULTURAL MANAGEMENT PRACTICES ON FOREST ECOSYSTEMS,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
F. R. Larson, P. F. Ffolliott, W. O. Rasmussen, and D. R. Carder.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 281-294, 1979. 19 ref.

Descriptors: Forest management, Forestry, *Ecosystems, Computer models, Simulation analysis, *Land use, Planning, Streamflow, *Forest practices.

A family of computer simulation modules was described that would aid forest managers and land use planners estimate the impact of management activities on the natural resources of the forst ecosystem. This family, called ECOSIM, includes three general modules: FLORA for estimating responses of the forest overstory, herbaceous understory, and organic matter; FAUNA for evaluating animal habitats, carrying capacity, and population dynamics; and WATER for assessing streamflow yield, sedimentation, and chemical quality. A command system enables users to operate all modules through a common language written in straightforward user terminology. The design gives flexibility in representing management activities by operating selected modules interactively on an appropriate data base. (See also W79-09185) (Skogerboe-Colorado State)
W79-09205

DEVELOPMENT OF BMPS FOR AGRICULTURE-NEW YORK STATE STRATEGY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
P. D. Robillard, M. F. Walter, and R. Gilmour.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 581-595, 1979. 7 fig, 7 tab, 6 ref.

Descriptors: *Water quality control, Water pollution control, Water management(Applied), Soil conservation, *Farm management, Planning, *New York, Sediment control, Farm practices.

The identification of specific problems, knowledge of the cause-effect relationships, direct installation costs and expected changes in farm income circumvent the choice of appropriate BMP's and their potential water quality benefits. How these concepts might be incorporated into a BMP development program for New York State was reviewed. Associated stages of BMP development and implementation techniques were proposed. Examples of this methodology were presented for two case study dairy farms. Candidate management practices were judged qualitatively and quantitatively in reducing potential soil, plant nutrient and manurial organic matter losses from cropland. Estimated changes in farm income were calculated for each measure. The risk in adopting new farm management measures and technology were considered in this BMP selection process. The potential for integrating soil erosion, agronomic recommendations and farm management concepts into the water quality elements of conservation farm plans was found to be good. Examples of this approach were presented. (See also W79-09185) (Skogerboe-Colorado State)
W79-09224

WATER POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09320

ENFORCEMENT OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 TO CONTROL NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09330

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ESTIMATING IMPACTS OF SILVICULTURAL MANAGEMENT PRACTICES ON FOREST ECOSYSTEMS,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
For primary bibliographic entry see Field 5G.
W79-09205

SIMULATION OF STORMWATER RUNOFF AND SEDIMENT YIELD FOR ASSESSING THE IMPACT OF SILVICULTURE PRACTICES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W79-09206

METHODOLOGY FOR DETERMINING THE OPTIMAL MIX OF BMP'S AND AGRICULTURAL PRODUCTION MODIFICATIONS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. P. Heaney, and D. C. Ammon.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 649-664, 1979. 17 fig, 1 tab, 11 ref.

Descriptors: Pollution abatement, Pollutants, Detention reservoirs, Sediment control, Linear programming, *Model studies, Sediment discharge, Dairy industry, *Farm practices, Farm wastes.

A simple procedure for determining the optimal mix of upstream and downstream controls in an urban area was presented by Heaney and Nix (EPA-600/2-77-083, 1977). This procedure was extended to permit evaluation of agricultural areas. The main difference between urban and agricultural problems is that the farmer may consider production modifications in response to an imposed restriction on pollutant discharge. A linear programming model was developed earlier by other research workers which allows one to determine the production adjustments that could be made on a dairy farm facing nutrient limitations. This model was coupled with information on Best Management Practices' effectiveness presented in another publication and was extended to evaluate waste management problems. (See also W79-09185) (Skogerboe-Colorado State)
W79-09227

INTERNATIONAL SYMPOSIUM ON LOGISTICS AND BENEFITS OF USING MATHEMATICAL MODELS OF HYDROLOGIC AND WATER RESOURCE SYSTEMS,
Preprints of Symposium held at Universita di Pisa, Italy, 24-26 October 1978. Convened by the International Institute for Applied Systems Analysis, Laxenburg, Austria, & co-sponsored by World Meteorological Organization, IBM Centro Scientifico, 1978. 584 p, 113 fig, 44 tab, 110 equ, 160 ref.

Descriptors: *Logistics, *Benefits, *Mathematical models, *Hydrologic systems, *Water resources, *Simulation analysis, *Computer programs, *Forecasting, *Water management(Applied), Optimization, Computer models, Floods, Decision making, Rivers, Planning, Costs, *Analytical techniques, Systems analysis.

Mathematical models are widely used for the simulation, analysis, and control of hydrologic and water resource systems. Although many of these models have been in use for several years and have been described at a number of conferences in terms of their basic structure and mathematical formulation, an exchange of experience in the operational aspects and logistics of these models occurs very rarely; this Symposium's purposes was to produce an exchange of ideas, knowledge and experience in this area of hydrologic and water resources modeling. The emphasis is on model implementation and use, including questions of logistics such as computer requirements and support staff, data needs and the cost-benefit of models in practical work. The proceedings is divided into four sections: (1) on-line simulation in hydrology, including flood, flow and runoff forecasting: (2) non-real-time simulation in hydrology; (3) simulation of water resources systems, considering planning and management problems; and (4) suites of programmes. Represented are numerous analytical techniques for simulation and optimization. (See W79-09286 thru W79-09313) (Bell-Graf--Cornell)
W79-09285

THE THAMES BASIN WATER RESOURCES MODEL,
Thames Water Authority, London (England).
J. R. Sexton.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 15 p, 6 fig.

Descriptors: *Water resources, *Simulation analysis, *Computer models, *Model studies, *Thames River basin(England), Water demand, Water supply, Computer programs, Aquifers, Digital computers, Effects, Hydrology, Rainfall, Management, Systems analysis.

In order to improve the evaluation of Thames Water's existing water resources and to assist in rolling forward the strategy to meet the anticipated growth in demand, a simulation model of the water resource system has been built. It is essential that consideration be given to the whole river basin when an enhancement to the system is being planned. This paper discusses the construction and use of the Thames Basin Water Resources Model. Designed first was the existing water conservation system. The physical system was defined in terms of components such as rivers, aquifers, reservoirs, demand centers, abstraction points, and effluent returns. Given herein is the model philosophy discussed is the unconfined aquifer module, model input and output, system performance, and future plans for the model. The complexity of a typical modern water resource system is demonstrated The use of simulation techniques on modern digital computers makes it possible to analyze these complex interactions to give a sounder base for understanding and predicting the water cycle in both

quantity and quality. (See also W79-09285) (Bell-Graf--Cornell)
W79-09300

LONG TERM RESOURCES ALLOCATION FOR CONTROL PURPOSES IN A WATER MANAGEMENT SYSTEM,
Institute of Meteorology and Water Management, Warsaw (Poland).
Z. Kaczmarek, K. Malinowski, and K. Salewicz.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis, Laxenburg, Austria. 23 p, 3 fig, 32 equ, 9 ref.

Descriptors: *Resource allocation, *Long-term planning, *Water management(Applied), *Optimization, *Algorithms, *Decision making, *Decentralized decision structure, *Price coordination, Hierarchical, Interaction balance method, Computers, Constraints, Rivers, Reservoirs, Water demand, Mathematical models, Equations, Systems analysis, Decomposition techniques, Control.

In Poland, it has become important to consider complex water management systems directed towards the efficient use of limited water resources in the face of increasing demands, not to mention the maintenance of appropriate quality standards. Traditional methods being used presently have been developed to consider conflicting objectives. To derive a reasonable compromise between conflicting goals, one must repeatedly make use of the overall decision-making mechanisms using adequate models of water allocation in the considered region. The work reported herein utilizes the following decision-making structure: decentralized decision mechanisms with price coordination. Presented is how the water resource and quality management tasks expressed by a mathematical model can be adopted to one- or multi-computer decision-making structure by applying the price coordination for the overall long-horizon system optimization problem solving. Presented is a basic hierarchical optimization algorithm: the Interaction Balance Method. Presented also are the requirements the model poses on the data basis and information structure. Discussed are the possible applications in the operational control structures designed to maintain appropriate quantity and quality standards. Finally, the practical adaptation of the model to this decision structure is shown and the computational and informational aspects discussed. (See also W79-09285) (Bell-Graf--Cornell)
W79-09302

DEVELOPMENTAL AND OPERATIONAL ASPECTS OF GAMING-SIMULATIONS FOR WATER RESOURCE SYSTEMS,
Water Resources Commission, Sydney (Australia).
G. L. Wright.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Reprint at Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 7 p, 5 ref.

Descriptors: *Gaming, *Simulation analysis, *Water resources development, Computer programs, Benefits, Decision making, Costs, Computer models, Systems analysis.

When designing large and complex water resource systems, one will almost certainly encounter conflicting goals. Gaming-simulation has become an accepted method of modeling environmental systems where conflicts and competition for a limited resource play a vital role. This approach amounts to an enlargement of the boundaries of the system being modeled beyond the physical and purely economic systems to include human decision makers. This paper outlines the developmental and operational problems likely to occur during the application of the gaming-simulation approach to the modeling of a water resource system. Also, requirements, in terms of manpower and computing facilities, for its implementation are discussed. The Water Resources Allocation Game (WRAG), which was developed to examine the problem of allocating a stochastic supply of water among competing users in the Upper Hunter Valley of New South Wales, Australia, is discussed as an example of a complex gaming-simulation. It is found that development and operation costs associated with a gaming-simulation are significantly higher than for a conventional all-computer simulation of similar complexity. However, where a simulation is to be developed to solve problems or plan the development of a water resource system in which conflicts occur between parties having interests in the planning and management of the available water and land resources, the benefits derived from a gaming-simulation may far outweigh the additional costs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09303

LOGISTICS OF LARGE-SCALE WATER RESOURCES MODELING FOR IRRIGATION PLANNING,
Hydrotechnic Corp., Madrid (Spain).
H. S. Nelson, P. Savasdibutr, R. K. Thomas, and D. P. Loucks.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis, (Laxenburg, Austria). 16 p, 2 fig, 1 ref.

Descriptors: *Water resources, *Land resources, *Optimization, *Agriculture, *Modeling approach, *Logistics, *Data analysis, *Food production, *Irrigation, *Planning, Water supply, Scarce water, Computer models, Linear programming, Reliability, Equations, Yield, Computer programs, Projects, Constraints, Benefit maximization, Cost minimization, Systems analysis.

Hydrotechnic and its consulting specialists have developed modeling techniques for national or regional water resources and agricultural planning, the goal being to produce an optimum water resource infrastructure to enable achievement of the highest degree of food production. Current national markets compete for scarce food supplies at increasing international prices, and countries see the need for achieving the utmost self-sufficiency in producing agriculture-based food. Required is increased development and more efficient utilization of national resources. Over the past decade, a computerized modeling approach to water resource and agricultural planning has been developed and successfully applied in a number of countries. This paper reviews some of the experiences in applying this approach to classify national resources and evaluate potential irrigable areas according to varying soil productivity levels for large numbers of different crops within the constraints of climate, characteristics of soils, water quantity, reliability and quality, labor availability and farming methods employed, required processing facilities, and marketing considerations. Discussed are optimization techniques, using cost minimization and benefit maximization. It is shown that model outputs were in a flexible form that identified both short- and long-term decisions. After developing an adequate national data base, a computerized multi-disciplinary approach was used to examine a wide range of development options and objectives, thus permitting national level decision makers to make well-informed choices given various political and socioeconomic constraints. (See also W79-09285) (Bell-Graf--Cornell)
W79-09304

MODEL FOR THE SELECTION OF APPROPRIATE TECHNOLOGY FOR A WATER RESOURCES SYSTEM,
Oklahoma Univ., Norman.
G. W. Reid.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 18 p, 4 fig, 11 ref.

Descriptors: *Water resources, *Technology transfer, *Process selection model, *Developing countries, *Water supply, Water pollution control, Waste water treatment, Waste disposal, Decision making, Systems analysis, Mathematical models.

Despite great efforts to improve the quality and quantity of water supplies in developing countries (LDC's), populations have increased faster than new facilities can be installed. The approach presented herein to aid in resolving this problem is: (1) to assist the LDC in using a system approach and in identifying the major alternatives; (2) to devise ways to present the alternatives to LDC decision makers, this facilitating diffusion; and (3) to assist LDC's in developing self-fufficiency in the selection or producing of appropriate technology. In 1973, a study was undertaken to develop a model to select appropriate (low cost) treatment methods for specific LDC sites. The model methodology has been tested for user and consumer acceptance, and methods are now being sought to implent its use. Discussed herein are the problem of the environmental setting, technology transfer, and the process selection model; dealt with is the dual problem of user acceptance of modeling and appropriate technology. Explored are the client/donar/modeler relationship and possible proactive and reactive programs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09305

MATHEMATICAL MODELS OF WATER RESOURCE SYSTEMS. SOME RECENT REALIZATIONS AT THE 'CASSA PER IL MEZZOGIORNO,'
Cassa per il Mezzogiorno (Italy).
F. Fabi, and G. Simonelli.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 51 p, 4 fig, 14 tab, 3 append.

Descriptors: *Water resources, *Mathematical models, *Simulation analysis, *Optimization, *River systems, Dams, Reservoirs, Constraints, Computer programs, Linear programming, Systems analysis.

For about eight years, the EDP Centre of the Cassa per il Mezzogiorno has studied and implemented automatic procedures for the analysis of water resource systems by means of mathematical models, this approach made possible by the availability of systematic hydrological data. The methods used are simulation and optimization. In applying both these techniques, different conceptual and operational problems have been faced and solved. Simulation techniques have been developed last, realizing a generalized interactive procedure (input loading - computation - output displaying) using APL Language. Its main characteristic is an 'end user' orientation, which results in a quick and easy management. Water systems can be described in very fine detail; several options are also allowed, both in I/O and operation. Optimization is applied using a linear programming package (MPSX) as a core of a procedure allowing: a quick fitting to different systems; an automatic processing of input data for all the different LP problems involved in the systems analysis; and an automatic reorganization of the solution according to the needs of both analysis and presentation of results. Emphasis has been put on the solution of decision problems more than on the research of comprehensive and sophisticated mathematical patterns and algorithms. The paper deals with applications of these methods to concrete decision problems faced during the last few years and shows an example of conjunctive use of simulation and optimization. (See also W79-09285) (Bell-Graf--Cornell)
W79-09307

MATHEMATICAL MODEL OF THE UPPER NILE BASIN,

World Meteorological Organization, Geneva (Switzerland). Dept. of Hydrology and Water Resources.
J. Nemec, and G. W. Kite.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 16 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Upper Nile Basin(Africa), *Lakes, *Computer models, *Computer programs, *Simulation analysis, *Logistics, *Constraints, Projects, Rivers, Catchments, Systems analysis.

The importance of logistics in modeling water resource systems is stressed. Described is the Hydromet Project, originated in 1967 as a cooperative venture between five African nations with the World Meteorological Organization as executing agency for the UN Development Program. After completing the first phase--collection and analysis of hydrologic and meteorologic data from lake catchments--a second phase aimed at developing a mathematical model to investigate alternative regulation patterns for the lakes to increase benefits to the riparian countries. Described is the computer model of the Upper Nile basin, which simulates the hydraulics of the River Nile, its lakes, and its tributaries. Discussed are: the catchment, lake and channel components; the master program; uses of the model; logistics of computer operation; constraints on model selection and building, including financial, data, location, hardware, and degree of sophistication constraints; and model benefits. The report contains a diagram of the model, an information flow diagram of the Upper Nile basin model, and a tabular outline of the computer programs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09309

LOGISTICS AND BENEFITS OF THE EUROPEAN HYDROLOGIC SYSTEM,
International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
M. B. Abbott, R. Clarke, and A. Preissmann.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 39 p, 3 fig, 5 ref.

Descriptors: *Logistics, *Benefits, *Computer models, *Water resources, *Hydrology, Simulation analysis, Investment, Costs, Industrial water, Water allocation(Policy), Water pollution, Water treatment, Reuse, Recycling, Thermal powerplants, Waste disposal, Agriculture, Water balance, Land use, Domestic water, Water supply, Flood control, Droughts, Navigation, Legislation, Systems analysis, Data requirements, Hydropower, Toxic wastes.

During the past 20 years, computer-based hydrologic models have been transformed from subjects of academic research into tools of engineering practice, taking on strategic importance in laboratories and institutes. This paper describes The European Hydrologic System (SHE), a most ambitious and demanding project. The production system should be available around 1980 and will be able to generate models capable of fulfilling a large part of the demands of engineering practice. Herein we find sections discussing: (1) the origins of SHE; (2) a description of SHE, including two schematic diagrams of its structure and of mass flow through the model; (3) system investment and cost; (4) data requirements; and (5) system application and benefits. The fifth section considers: (1) industrial water use, including pollution treatment and costing, reuse, and hydropower generation; (2) agricultural water use, including water balance of rainfed and of irrigated agriculture; (3) domestic water use, including changes in waste water disposal and supply sources, setting targets, and allocating funds; (4) flooding and flood management; (5) drought and drought loss management; (6) inland navigation; (7) legislation and litigation; and finally (8) quantification. It is expected that the use of SHE will, in time, influence data collection programmes providing an incentive to new approaches and especially encouraging methods of satellite imagery. Development of SHE to its full capacity will depend upon the development of complementary data collection programmes and instrumentation. (See also W79-09285) (Bell-Graf--Cornell)
W79-09310

THE IMPLEMENTATION AND APPLICATION OF A SUITE FOR THE SIMULATION OF COMPLEX WATER RESOURCE SYSTEMS IN EVALUATION AND PLANNING STUDIES,
North West Water Authority, Warrington (England).
D. Pearson, and P. D. Walsh.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 38 p, 6 fig, 2 tab, 8 ref.

Descriptors: *Simulation analysis, *Water resources, *Computer programs, *Computer models, *Hydrologic aspects, Regions, Management, Hydrologic data, Data flow, Systems analysis, *Data base.

Described are the development, structure, scope and management of a suite of programs, and associated data base, developed by the North West Water Authority for an environmental and engineering appraisal of new water resource systems. The paper delineates the hydrological analyses carried out for the study and in particular discusses the arguments for a general as opposed to a specific simulation program. The organizational aspects are discussed with reference to the use of the suite in major and minor investigations by staff in decentralized locations and to the general and wider use of the suite within the Authority. (See also W79-09285) (Bell-Graf--Cornell)
W79-09311

EXPERIENCES OF THE HYDROLOGIC ENGINEERING CENTER IN MAINTAINING WIDELY USED HYDROLOGIC AND WATER RESOURCE COMPUTER MODELS,
Hydrologic Engineering Center, Davis, CA.
B. S. Eichert.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 14 p, 4 tab.

Descriptors: *Water resources, *Hydrology, *Computer programs, *Computer models, Costs, Manpower, Logistics.

The basic purpose of the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers, Davis, California is to assist practicing engineers throughout the Corps in applying state-of-the-art technology to current planning, design and operation problems. This is accomplished by locating, evaluating and/or developing new modeling techniques, by teaching these in formal courses, by developing and maintaining a library of some 12 major state-of-the-art computer programs, and by assisting Corps offices in applying the techniques in current studies. This paper considers some of HEC's experiences in maintaining hydrologic and water resource computer models. Discussed are: major HEC programs; HEC cycle for computer program support, including research, documentation, training, user support, source deck distribution, and feedback; ways to encourage usage of the models; cost and manpower for program support; compatability with other computer systems; and implementing programs on other systems. The use of generalized models can be effective in accomplishing water resource studies if sufficient funds and manpower are provided to support the necessary functions described herein; information on manpower and costs provided may be useful in estimating the necessary logistic support required for similar support centers in other offices. (See also W79-09285) (Bell-Graf--Cornell)
W79-09313

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

6B. Evaluation Process

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitets vensen, Oslo.
For primary bibliographic entry see Field 2C.
W79-09152

PHYSICAL MODEL OF THE HYDROLOGY OF SLOPING HETEROGENEOUS FIELDS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 2G.
W79-09161

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-09169

SOCIAL COSTS AND EFFECTIVENESS OF ALTERNATIVE NONPOINT POLLUTION CONTROL PRACTICES,
Economics, Statistics, and Cooperative Service, Ames, IA.
For primary bibliographic entry see Field 5B.
W79-09208

PROCEDURE FOR ECONOMIC EVALUATION OF BEST MANAGEMENT PRACTICES,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 4D.
W79-09213

AN ECONOMIC ANALYSIS OF EROSION CONTROL OPTIONS IN TEXAS,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4D.
W79-09214

WATER QUALITY MODELING IN THE DELAWARE COASTAL PLAIN REGION,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-09220

EVALUATION OF CONTROLS FOR AGRICULTURAL NONPOINT SOURCE POLLUTION,
Meta Systems, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W79-09225

MATHEMATICAL MODELING OF WATER QUALITY EFFECTS OF AGRICULTURAL BEST MANAGEMENT PRACTICES,
URS Co., Seattle, WA
For primary bibliographic entry see Field 5B.
W79-09226

MODELING NUTRIENT EXPORT IN RAINFALL AND SNOWMELT RUNOFF,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5B.
W79-09228

MODELING SOIL AND WATER CONSERVATION PRACTICES,
Hydrocomp, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5B.
W79-09229

INTERACTIVE EFFECTS OF PESTICIDE PROPERTIES AND SELECTED CONSERVATION PRACTICES ON RUNOFF LOSSES: A SIMULATION STUDY,
Environmental Research Lab., Athens, GA. Technology Development and Applications Branch.
For primary bibliographic entry see Field 5B.
W79-09230

6D. Water Demand

FINAL REPORT OF THE GOVERNOR'S TASK FORCE ON WATER RESOURCES,
Kansas Water Resources Board, Topeka.
December 1978. 69 p, 15 photo, 1 append.

Descriptors: *Kansas, *Water resources, *State governments, Water supply, Governments, Groundwater, Groundwater resources, Water resources development, Water quality, Surface water, Environment.

Kansas has major water problems, and a crisis is on the horizon. The declining underground water supply of the western third of Kansas threatens the agricultural economy of the entire state. Some cities are experiencing severe difficulties with their supply and delivery systems, and new demands are confronting other communities, to say nothing about pollution troubles. Water problems in Kansas are as diverse as they are complex, and they defy artificial political boundaries. Affirmative action was taken this past year on 16 of the 19 recommendations in the Task Force's 1977 Interim Report. Similar acceptance of the 20 recommendations contained in this Final Report is desired. Combined, the two reports provide some much needed background information about Kansas water, the state's water management structure, and existing problem areas. A common thread in the recommendations is the repeated emphasis on water conservation, water purity and water management coordination. A brief summary of action taken on the recommendations listed in the Interim Report was presented. Additional comments on some of these recommendations and followup actions appeared as indicated under appropriate chapter headings in the Final Report. (See also W79-02700) (Froehlich-ISWS)
W79-09137

EVOLVING WATER LAW NEEDS FOR THE SOUTHEAST US,
North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 6E.
W79-09166

PENNSYLVANIA WATER LAW-REFORM IN PROGRESS,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 6E.
W79-09168

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 6E.
W79-09175

CONSERVATION ECONOMICS OF HAWAII'S SYSTEM OF WATER RIGHTS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W79-09182

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

6E. Water Law and Institutions

FINAL REPORT OF THE GOVERNOR'S TASK FORCE ON WATER RESOURCES,
Kansas Water Resources Board, Topeka.
For primary bibliographic entry see Field 6D.
W79-09137

EVOLVING WATER LAW NEEDS FOR THE SOUTHEAST US,
North Carolina State Univ., Raleigh. Water Resources Research Inst.
N. S. Grigg, D. H. Howells, W. E. Cox, and W. R. Walker.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division, July 26-28, 1978, Roanoke, VA. American Society of Civil Engineers, New York, N.Y., p 21-27, 1979. 10 ref.

Descriptors: *Water law, *Southeast US, *Water management(Applied), Saline water, Intrustion, Land use, Riparian rights, Surface waters, Groundwaters, Public access, Inter-basin transfer, Shore protection, Reservoir sites.

The current status of water law needs in the Southeast is presented. A background for future evaluation of these needs on a state-by-state and regional basis is provided. Despite no new research results, a basis for future research into water law issues is presented. A brief discussion of some of the issues identified by the states and how each state has modified their water law is included. The need of the southeastern states for water law changes must be approached on an individual basis. Although these states have considerable water supplies, they must recognize that careful water management must be developed through appropriate water law and institutions. The riparian doctrine (in its pure form) has long proven inadequate in the Southeast. Modifications of the Doctrine were observed already in several states. The Southeastern states must ask themselves in the future whether their body of water laws are adequate to meet emerging needs. (Coffey-Florida)
W79-09166

DEVELOPMENT OF WATER LAW IN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA.
W. E. Cox, and W. R. Walker.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 28-40, 1979.

Descriptors: *Virginia, *Water allocation(Policy), *Water courses(Legal aspects), *Groundwater, Administration, Adoption of practices, Water control, Water conservation, Water management(Applied), Water policy, Water resources, Water law.

Virginia water law has undergone considerable development in the past decade. The common law doctrines that traditionally served to allocate surface and groundwater have been supplemented by statutory controls. In addition to these supplemental controls, an administrative allocation system has replaced the common law system for allocation of groundwater in certain regions of the state. The existing allocation mechanisms for groundwater under the Ground Water Act of 1973, and natural water courses management are discussed. There are several deficiencies that should be remedied and additional issues that should be addressed as the state re-appraises its water allocation institutions. Much data from other states' experiences exist as to the feasibility and consequences of various water allocation institutions. Institutions must be adapted to a particular states' conditions but much can be gained from comparative analysis. Consideration of other states' experiences will allow Virginia to benefit from their mistakes in developing its water law. (Coffey-Florida)
W79-09167

PENNSYLVANIA WATER LAW-REFORM IN PROGRESS,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
R. T. Weston.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 41-51, 1979.

Descriptors: *Pennsylvania, *Water allocation(Policy), *Water control, Water management(Applied), Watershed management, Inter-basin transfer, Watershed(Basins), Water quality control, Water uses, Agricultural runoff, Mine drainage, Resource allocation.

Pennsylvania has no existing institutional approach capable of managing both its ground and surface water resources. Developed during a period of abundance, current laws and programs are not designed to deal with shortage conditions or allocate water among competing users. Water uses can be initiated without any review of consideration of whether adequate supplies will be available to sustain all diversions and instream uses within a watershed. A few of the important water law issues and options being considered by Pennsylvania through its comprehensive Water Quality Management Planning Program (COWAMP) are highlighted. COWAMP encompasses all elements of wastewater management including point and nonpoint sources of pollution, agricultural runoff, abandoned mine drainage, sludge disposal and ground-water quality. Its overall objective is to establish a cost-effective, long-range basis for water quality management in Pennsylvania. The major policy and program options are explored. Pennsylvania can no longer afford to muddle through the management of its valuable water resources. It is time to consider how Pennsylvania will wisely manage those resources in the interest of all its citizens. (Coffey-Florida)
W79-09168

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
C. F. Kiker, G. D. Lynne, and A. Starr.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 52-64, 1979. 24 ref.

Descriptors: *Administration, *Economic efficiency, *Florida, *Distribution systems, Water resources, Distribution, Alternative costs, Comparative costs, Comparative benefits, Common law, Water law.

Eastern common law water doctrines are based on the concept that water is a common property resource. Everyone has an entitlement to use with no specific private rights. Statutory modification of eastern water law doctrines to include administration is a response to the inadequacies of common law doctrines. The 1972 Florida Water Resources Act is an example of an administrative system. The relationship between the management authority and private water users is discussed. Specifically, questions of economic efficiency and distribution are posed. There are four sections: Section (1)

deals with the allocation basis of specific water quantities to private users under Florida's administrative system; Section (2) addresses alternative approaches to allocating private water entitlements. These alternatives are based on various aspects of water law and are evaluated from an economic perspective; Section (3) introduces a present study undertaking a quantitative evaluation of the alternative allocation approaches from an economic perspective; and Section (4) concludes there are several alternative approaches to assigning water entitlements feasible under eastern water law. Each has different economic impacts on water users. Without analysis, the magnitude of these impacts are indeterminable. Included are 24 references. (Coffey-Florida)
W79-09169

THE APPROPRIATE RIGHT AS COMMON LAW,
Nevada Univ., Reno.
J. W. Bird.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 81-87, 1979. 11 ref.

Descriptors: *Appropriation, *Common law, *Riparian rights, *Nevada, Water rights, Water law, Priorities, Control, Water management(Applied), Water distribution(Applied).

Problems of water rights, obligations and duties associated with water use generally belong to either of two classes: riparian and/or appropriative. The riparian right is typically referred to as a 'common law' right. The appropriative right is introduced or governed by statute. The need for this distinction in the western states generally and specifically in Nevada is questioned. The common law is subject to change. It may be possible to have a declaration by the courts that the appropriation doctrine is a part of the common law of the state. This would provide legal continuity for better control over the available water in the state. Portions of the appropriation statutes that have never been construed could be examined as a formalized or written segment of the common law and not as a separate entity from the common law. This would tend to clarify the entire appropriation picture. (Coffey-Florida)
W79-09170

RESERVED RIGHTS AND FEDERAL CLAIMS TO WATER,
Colorado State Univ., Fort Collins.
N. Wengert.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 93-107, 1979.

Descriptors: *Appropriation, *Public rights, *Forest management, *Federal-state water rights conflict, Prior appropriation, Priorities, Beneficial use, Water rights, Riparian rights, Water uses, Forest watersheds.

The Reserved Rights Doctrine (Doctrine) was developed and applied by the federal courts in the semi-arid western states. In this area, appropriation principles of water law are dominant, and the public domain and withdrawals from it by the federal government represent important aspects of land ownership and management. The potential conflict between the Doctrine which established federal water rights in the west and state principles of prior appropriation water rights is discussed. A summary is provided of the principles of western water law contrasted with eastern water law. The evolution of the appropriation doctrine is traced. A lengthy analysis of the federal reserved rights as clarified by case law is presented, special attention being to Arizona v. California, U.S. v. New Mexico (The Mimbres Opinion) and Colorado cases. The interests of the Forest Service in western management are also analyzed. The effect of the Mimbres opinion on the goal of forest management is examined. (Coffey-Florida)
W79-09171

WESTERN WATER LAW AND IRRIGATION RETURN FLOW,
Colorado State Univ., Fort Collins.
G. E. Radosevich, and G. V. Skogerboe.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE) Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1979, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 108-120, 1979.

Descriptors: *Irrigation operation and maintenance, *Irrigation effects, *Return flow, *Irrigation design, Water pollution sources, Irrigation, Irrigated land, Irrigation efficiency, Irrigation water, Water quality control, Agriculture.

Water pollution from irrigated agriculture in the west has recently received much attention. This is a result of federal and state endeavors to identify irrigation return flow quality problems and to develop a viable control strategy. Water quality control laws are recent, relatively uniform among states, and usually constrain improvement of return flows from irrigated agriculture. Water quantity control and management laws are complex, voluminous, inconsistent and lack uniformity among the 17 western states. The Influent Control Approach (ICA) is based upon the assumption that improved water management and agricultural practice, will significantly contribute to improved water quality. The ICA consists of eight components to be carried out by the states: (1) Designation of problem areas; (2) Development of standards and criteria for beneficial use; (3) Introduce incentives for more efficient water use; (4) Addition of water quality to water rights; (5) Adoption and enforcement of a reporting and recording system for water rights; (6) Recognition of reasonable degradation from agricultural water use; (7) Adoption of Agricultural Practices Act; and (8) Promotion of cooperation and integration of state water agencies. (Coffey-Florida)
W79-09172

LEGAL IMPLICATIONS OF INCREASING THE AVAILABILE WATER,
Blatchley Associates, Inc., Denver, CO.
V. P. Soicel, and R. K. Blatchley.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 121-129, 1979. 12 ref.

Descriptors: *Water yield improvements, *Water allocation(Policy), *Water utilization, *Water supply development, Political constraints, Water demand, Weather modification, Evaporation control, Appropriation, Hydrologic cycle, Water supply.

Western states have adopted a legal system of allocating a scarce water supply to those who have been first to apply the water to a beneficial use. The law has recognized both the limited supplies available and the need to efficiently utilize those resources. Every state prohibits water waste; yet, they forego opportunities to increase supplies while demand grows. Our legal system of allocating water needs revamping. The current water law and the potential for providing private incentives for developing greater supplies are analyzed. Determining the appropriate incentive for increasing available water supplies depends upon the developer's ability to quantify the increased supply and to protect vested rights. This means the continued use of the prior appropriation concept, but not continued piecemeal adjustments to the concept which promote complexity and confusion. A first step to simplifying the present appropriation system is to provide a scientific basis for the decision-making process. The most important aspects are understanding the hydrological cycle and where a particular proposal may affect that cycle. (Coffey-Florida)
W79-09173

INDIAN WATER RIGHTS: LAW AND REALITY,
S. Smith.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 131-137, 1979.

Descriptors: *Federal reservations, *Indian reservations, *Federal-state water rights conflicts, Federal jurisdiction, Agriculture, Irrigable land, Water users, Water supply, Water resources, Water rights.

The last 125 years have seen the isolation of Indians on reservations, usually on land considered undesirable for any other purpose when created. In 1908 the Supreme Court decided the Winters Case stating that Indian water rights are based on future needs not present uses. This case provided the legal basis for asserting the reservation Indians' water rights. The quantity of water reserved for Indians was at issue in Arizona v. California. The decided quantity became the lesser of one million acre-feet or the amount intended to satisfy the future as well as the present needs of the Indian Reservations so that enough water was reserved to irrigate all irrigable reservation acreage. This measure has become entrenched despite its ambiguity. The Winters decision presupposed no particular use while Arizona based the measure on agriculture alone. A quantum for other uses has never been set. Recent court decisions have increased the states' role in the determination of Indian/federal water rights. There should be Indian/federal and state negotiations to protect Indian water rights. (Coffey-Florida)
W79-09174

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
J. E. Flack.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 143-149, 1979. 10 ref.

Descriptors: *Water rights, *Water uses, *Efficiencies, *Water shortage, Wastes, Withdrawal, Conservation, Water supply, Basins, Waste water disposal, Water law.

Every modern American water law doctrine prohibits the waste of water. To make a beneficial use of withdrawn water, it is almost always necessary to divert more water than is actually needed at the place of use. The reduction in the withdrawal of these excess quantities is defined as conservation. By conserving water, savings can result. The capture of this saved water, and the entitlement to its use, is discussed. A brief analysis is presented of the case law as applied to increased water use efficiency and to entitlement to saved water. One who can show that he has actually increased the water supply above that naturally available may obtain title to that water regardless of other's rights. In those cases, where someone downstream has appropriated waste water, part of the natural supply of the basin where used there will be some question of entitlement to the water, especially in appropriation states. Some water is likely to be handled as part of the natural supply, with the

same priorities and allocation as that supply. (Coffey-Florida)
W79-09175

INTERRELATING LAND AND WATER MANAGEMENT IN FLORIDA,
F. E. Maloney, and R. G. Hamann.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 150-169, 1979.

Descriptors: *Florida, *Water management(Applied), *Land management, *Comprehensive planning, Land resources, Land development, Land use, Water law, Water policy, Water resources, Water utilization, Water districts.

Today there is general agreement that whatever is done with water will have some impact on what can be done with the land and vice-versa. Despite physical interrelationships and a consensus among knowledgeable persons that unity is needed, land and water planning and management have historically proceeded along separate paths. A surge of political activity by environmentalists led to the passage between 1972 and 1975 of several significant new laws in Florida that plan and regulate the impact of human activity on land and water resources. An extensive analysis is presented of the 1972 Environmental Land and Water Management Act, the 1972 Florida State Comprehensive Planning Act and the 1975 Local Government Comprehensive Planning Act. There is a need to develop a comprehensive, holistic approach to resource use. The key to attaining that goal is greater communication and cooperation among the agencies responsible in this area. (Coffey-Florida)
W79-09176

NAVIGABLE WATERWAYS: THE NEW HAMPSHIRE EXPERIENCE,
Environmental Assessment Council, Inc., New Brunswick, NJ.
M. J. Schiffman.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 179-192, 1979.

Descriptors: *Navigable waters, *New Hampshire, *Federal jurisdiction, *Federal-state water rights conflicts, Regulation, Federal government, Navigable rivers, Navigation, Administrative agencies, Coast guard regulations, Water rights.

In 1975 the Coast Guard declared 'the narrows' of New Hampshire's Lake Winnisquam navigable and subject to United States jurisdiction. This decision was based on a series of court decisions which gave rise to two concepts: (1) To be navigable, waterways need not be navigable in their natural state as long as reasonable improvements may create a feasible use for interstate commerce; and (2) once a waterway is navigable, that status is retained regardless of any construction which may deter practical commercial travel. The finding of navigability was also supported by the 1971 Federal Boat Safety Act designed to bring uniformity to boat registration and safety requirements. Prompted by fears of losing boat registration fees, reductions in police enforcement and waterway pollution, New Hampshire challenged the Coast Guard's finding. How the federal claim arose, developed and was subsequently dropped is examined. After examining the long history of court opinions from which the definition of navigability has evolved and after questioning its applicability today it is suggested that the term must be more clearly defined. (Vloedman-Florida)
W79-09177

WATER RESOURCES TECHNOLOGY AND WATER LAW,
Portland State Univ., OR.
R. E. Miller.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning of Civil Engineers, New York, N.Y., p 193-203, 1979.

Descriptors: *Water law, *Colorado, *Judicial decisions, *Technology, Water policy, Water resources, Administration, State governments, State jurisdiction, Engineering, Planning.

One major concern in effective water resource management is the interaction among economic, political and legal aspects of such management and the resource's technical setting. Two Colorado Supreme Court cases are analyzed in order to investigate and make recommendations regarding the entry into evidence of water resources technology. Six distinguishable ways by which technology may be admitted into evidence are discussed: (1) Expert and non-expert testimony; (2) Judicial notice; (3) special jury; (4) specialized courts; (5) court appointed masters and referees; and (6) administrative hearings. There are two types of problems associated with the water resources information the courts receive. First, the presentation of facts is often unsound, misleading, and incorrect. Often not detected by the trial court, these errors become part of the record and are used by the appellate courts since they take no new evidence. The second problem is that technological information is presented by attorneys who will use only that information supportive of their case. Therefore, information which would be in the public interest may not be presented. (Vloedman-Florida)
W79-09178

STATE WATER LAWS: EFFECT ON ENGINEERING SOLUTIONS,
Army Engineer District, Galveston, TX.
For primary bibliographic entry see Field 4A.
W79-09179

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
O. Helweg, and W. Brooks.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of the 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 326-339, 1979. 10 ref.

Descriptors: *California, *Groundwater basins, *Water quality control, Lake basins, Inter-basin transfers, Groundwater, Pumping, Degradation(Decomposition), Drainage water, Water districts, Water management(Applied).

The problems of overpumping and groundwater degradation in the Tulare Lake Basin in the Central Valley of California are discussed along with some of the proposed solutions. Intra-basin transfers could reduce the need for imported water and decrease the size of the proposed drain to export drainage water of low quality out of the basin. There are major legal and institutional obstacles to a basin-wide management scheme. California has little or no formal groundwater law. There are three main approaches to manage the basin: (1) the 'do nothing' approach in which the groundwater would continue to degrade and water levels would continue to fall, until the pumping became uneconomical and/or the groundwater became too saline to use; (2) established pumping limits through court action, which is very expensive and time consuming; and (3) formation of an overall water district or confederation of districts. This is also complex because of the great number of existing districts and the lack of committment to a basin-wide solution. Presently, all of these alternatives are being investigated. Maps and diagrams are included. (Coffey-Florida)
W79-09180

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
J. D. Aiken, and R. J. Supalla.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 484-98, 1979. 10 ref.

Descriptors: *Nebraska, *Groundwater resources, *Water management(Applied), Groundwater availability, Irrigation, Irrigation effects, Irrigation water, Well regulations, Well spacing, Water allocation(Policy), Local governments.

Historically, Nebraska had permitted unlimited groundwater development subject only to ineffectual local groundwater control. Since the 1976 Ground Water Management Act (GWMA) was passed, Nebraska has been the most active of the major groundwater-using states in pursuing effective local groundwater control. The GWMA's potential effectiveness as a ground water control mechanism is evaluated. The various groundwater control authorities created by the GWMA and their collective management of declining groundwater levels associated with irrigation are assessed. The GWMA appears to be an effective mechanism for managing declining groundwater levels, and a model which states interested in groundwater control should consider. Because it represents a first step toward total groundwater management, the GWMA has some limitations. In spite of these limitations, the GWMA represents a significant step in ground water management policy. (Coffey-Florida)
W79-09181

CONSERVATION ECONOMICS OF HAWAII'S SYSTEM OF WATER RIGHTS,
Hawaii Univ., Honolulu. Water Resources Research Center.
H. Yamanchi.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 499-510, 1979.

Descriptors: *Hawaii, *Water distribution(Applied), *Conservation, *Economic efficiency, Water, Water conservation, Water policy, Water rights, Water supply, Water users, Water demand, Water resources.

The problems of conserving and allocating scarce water resources among competing users and uses in Hawaii have been compounded by legal and economic uncertainties. Hawaii's system of water rights has been labeled unique. It has evolved from ancient customs and does not clearly fit within the riparian-appropriation schemes of other mainland states. Two important results of this unique evolution have been the preservation of a strong private property orientation for water resources and a relatively undeveloped governmental framework for controlling decisions at the operating level. Maximum security and flexibility to private owners do not necessarily assure responsiveness of the system to conservation in the public's interest. Institutional innovations are the key to improving water resources conservation and management in Hawaii. Ambiguities in water rights are being tested in the courts. Attention has been directed to the original common Hawaiian property concept. Ownership, usership and transfer are basic tenure concepts which need clarification for furthering the reasonable beneficial use principle. Anchoring this broad and flexible principle in state water policy can serve as the basis for modernizing water regulations and administration in Hawaii. (Ewing-Florida)

W79-09182

BYZANTINE DRAINAGE LAW: PENNSYLVANIA'S EXPERIENCE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
R. T. Weston.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 637-646, 1979.

Descriptors: *Pennsylvania, *Stormwater, *Flood control, *Drainage, Storms, Water policy, Flood damage, Flood water, Drainage practices, Drainage programs, Legal aspects, Water law.

Pennsylvania has abundant water resources. This bounty has at times also been the scourge of Pennsylvania's citizens. Flooding has damaged human settlements from the earliest days of the colonial proprietors. Increasingly, the costs of uncontrolled drainage modifications and stormwater management have fallen on the State and Federal budgets through damage to public facilities, flood relief to injured communities, and revenues lost through unemployment and tax adjustments to damaged properties and businesses. Much of Pennsylvania's stormwater management and flooding problem can be traced to Byzantine common law drainage rights doctrine. A number of statutory and administrative programs also affect the stormwater picture. The goals of future stormwater policy include: (1) a more coordinated approach to stormwater maintenance; (2) prior planning; (3) conservation of natural drainage characteristics; (4) addressing stormwater problems on a watershed basis; (5) flexibility and certainty in drainage rules; (6) compatibility with other water resource and environmental objectives; (7) stormwater management as an integral part of land use planning and development programs; and (8) future programs which are administered and implemented through realistic manpower and budgetary resources. (Ewing-Florida)
W79-09183

LEGAL PROBLEMS OF STORMWATER POLLUTION ABATEMENT,
Spessard L. Holland Law Center, Gainesville, FL.
B. D. E. Canter.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 660-667, 1979.

Descriptors: *Storm water, *Pollution abatement, *Storm runoff, *Florida, Federal water pollution control act, Legal aspects, Political aspects, Political constraints, Runoff, Riparian rights, Legislation, Design standards, Performance, Land management.

Legal problems with stormwater runoff abatement (SRA) arise from the nature of runoff itself. As a nonpoint pollution source, SRA is difficult to quantify and evaluate. Control programs are hard to develop and subsequently defend in the courts when challenged. Section 208 of the Federal Water Pollution Control Act mandated that something be done about SRA and other major nonpoint pollution sources. Inadequate funding and a lack of political support for control programs have become formidable obstacles for the agencies responsible for water quality management planning. The requisite authority already exists in most states to begin abating SRA pollution. The regulatory agencies must now begin to utilize that authority to implement sound and comprehensive SRA programs. Utilization of Best Management Practices and design and performance standards will be the new methodology for controlling nonpoint source pollution. These presage increased land use restrictions. Careful and extensive data collection will be the key to defending the reasonableness of any SRA control program. (Coffey-Florida)
W79-09184

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE, PROCEEDINGS, 1978 CORNELL AGRICULTURAL WASTE MANAGEMENT CONFERENCE.
For primary bibliographic entry see Field 5G.
W79-09185

NONPOINT SOURCE POLLUTION CONTROL STRATEGY,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5B.
W79-09186

RESEARCH NEEDS AND CURRENT ACTIVITIES,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
For primary bibliographic entry see Field 5G.
W79-09189

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE: AN INTEGRATED OVERVIEW,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-09190

CONSERVATION DISTRICT INVOLVEMENT IN 208 NONPOINT SOURCE IMPLEMENTATION,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-09191

BEST MANAGEMENT PRACTICES FOR SILVICULTURE,
Weyerhaeuser Co., Tacoma, WA.
For primary bibliographic entry see Field 5G.
W79-09203

MANAGEMENT AND FINANCING OF AGRICULTURAL BMPS,
URS Co., Seattle, WA.
J. M. Rice.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 329-340, 1979. 2 fig, 1 tab, 5 ref.

Descriptors: Water quality control, *Planning, Management, *Agricultural runoff, *Water pollution sources, Water pollution control, Programs, Nonpoint sources, Farm practices.

One of the major goals of the Section 208 areawide waste management planning program, mandated by PL 92-500 and administered by the U.S. Environmental Protection Agency (EPA), is to develop solutions to identified water pollution problems which can and will be put into practice. The agricultural program developed in SNOMET/King County (Wshington) represents one approach to implementing nonpoint water pollution control measures which both satisfies the technical and other requirements of EPA concerning water quality management and satisfies the more pragmatic requirements of working farmers who are concerned both about making a living and about conservation. This paper presented the results of that program with special emphasis on unique aspects of the social and political setting of the SNOMET/King County area. The implemented program is in one sense no different than those developed in many other agricultural areas of the country; yet its acceptance by the local farming community and their willingness to participate in implementation of the program represent an institutional achievement in itself. Process, not product, then was a major focus of this paper. (See also W79-09185) (Skogerboe-Colorado State)
W79-09209

THE POLICY RELEVANCE OF ALTERNATIVE INSTITUTIONAL APPROACHES TO 208 PLANNING,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
A. Hamilton, and L. W. Libby.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 419-428, 1979. 4 tab, 3 ref.

Descriptors: Water quality control, Water quality act, *Planning, Decision making, Alternative planning, Local governments, *Nonpoint sources, Farm practices.

The power to implement many of the best management practices to control nonpoint pollution being considered in 208 planning lies with local governments (county, city, town, village). But the planning for reduction of nonpoint sources of pollution is between coordination and implementation that occur at these two different institutional boundaries were examined. It was believed that this research will have relevance not only to the water quality planning process but to a number of other planning exercises as well. The paper has drawn preliminary conclusions on the policy relevance of the different planning models discussed. (See also W79-09185) (Skogerboe-Colorado State)
W79-09215

INSTITUTIONAL AND TECHNICAL ASPECTS OF THE DEVELOPMENT OF AGRICULTURAL BMPS IN A FIVE-COUNTY RURAL/URBAN MICHIGAN REGION,
Williams and Works, Inc., Grand Rapids, MI.
For primary bibliographic entry see Field 5B.
W79-09217

APPROACH FOR ANALYZING AND MANAGING AGRICULTURAL NONPOINT SOURCES IN THE STATE OF MARYLAND,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
For primary bibliographic entry see Field 5B.
W79-09222

DEVELOPMENT OF A '208 PLAN' FOR AGRICULTURAL NONPOINT POLLUTION SOURCES IN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-09223

ALTERNATIVES TO APPROPRIATION LAW,
Wyoming Univ., Laramie.
F. Trelease.
In: Water Needs for the Future, Nanda, V.P., ed., p 59-81., Westview Press, Boulder, Colorado, 1977.

Descriptors: *Appropriation, *Water allocation(Policy), *Economic justification, *Alternative planning, Economics, Economic efficiency, Administrative agencies, Administrative decisions, Permits, Environmental effects, Prior appropriation.

Recently, many water laws throughout the world have been subjected to review and reconsideration. A search is being made for new and modern forms of water law. Older systems of self-generating rights are to be discarded. In the search for a new system, the administrative allocation of water; is frequently advocated, although its meaning is not always clear. The major objective of any water law must be to achieve, or at least promote, the efficient allocation of water resources. Economic efficiency is the reference: that combination of labor, capital, and resources which will produce the greatest net benefits. Social and environmental factors will be worked into the cost-benefit analysis. State plans, programs, and policies may determine the optimum to be sought, and state projects

and agencies may contribute to reaching it. However, in most countries a very large contribution toward optimum use of water for irrigation and industry will come from private sources. The water law system must foster and encourage water use and provide a climate conducive to investment in water-using enterprises. (Coffey-Florida)
W79-09315

LEGAL RESTRAINTS AND RESPONSES TO THE ALLOCATION AND DISTRIBUTION OF WATER,
Denver Univ., CO.
M. D. White.
In: Water Needs for the Future, Nanda, V.P., ed., p 117-131, Westview Press, Boulder, Colorado, 1977.

Descriptors: *Water distribution(Applied), *Water control, *Water allocation(Policy), Water resources, Appropriation, Riparian rights, State government, Federal government, International waters, Surface waters, Underground streams.

The legal aspects of water allocation and distribution are governed by three variable factors: (1) the law being applied - which could be state, interstate, federal, or international; (2) the legal classification of the water involved-an artificial distinction between surface and underground stream waters on one hand and underground percolating water on the other; and (3) whether one is dealing with the initial allocation or a second generation allocation. An overview of these factors is presented including the following topics: (1) state law on stream water (the appropriation and riparian doctrines) and underground water; (2) interstate allocation and distribution; (3) federal law including navigation servitude, U.S. reserved rights, water pollution control, and federal projects; (4) international allocation; (5) problems of initial allocation in riparian and allocation jurisdictions and problems of second generation allocation; and (6) miscellaneous aspects of water resouce allocation and distribution, such as minimum stream flows, developed water, anti-export statutes, basin of origin protection, constitutional preferences, condemnation of water rights, and the relationship between water allocation and land use controls. (Coffey-Florida)
W79-09316

ALLOCATION AND MANAGEMENT OF INTERSTATE WATER RESOURCES: THE EMERGENCE OF THE FEDERAL-INTERSTATE COMPACT,
Devevoise and Liberman, Washington, DC.
J. C. Muys.
In: Water Needs for the Future, Nanda, V.P., ed., p 83-104, Westview Press, Boulder, Colorado, 1977, 1 app.

Descriptors: *Water allocation(Policy), *Interstate compacts, *Water management(Applied), Federal project policy, State governments, River basins, Water resources, Water pollution control, Flood control, Political aspects.

A mechanism was built into the United States Constitution to deal with interstate water problems. Article I, Section 10, Clause 3 provides for the continued use of interstate agreements or compacts, subject only to the requirement of Congressional consent to such agreements. A brief survey of the use of interstate compacts in the water resources field is presented. Water compacts (other than those relating to navigation and fishing) may be grouped into four categories relating generally to: (1) water allocation; (2) pollution control; (3) flood control and planning; and (4) comprehensive water regulation and project development programs, or the federal interstate compact. A Congressionally approved regional institutional arrangement is needed. This will mandate cooperative coordinated action by federal agencies in conformity with the views of the affected basin states, while necessarily reserving the federal government's right to assert the paramount national perogative in appropriate situations. Included is a two-page appendix which lists compacts relating to the planning and management of interstate water resources. (Coffey-Florida)
W79-09317

TRANSMOUNTAIN DIVERSIONS OF WATER IN COLORADO,
Moses, Wittemeyer, Harrison and Woodruff Boulder, CO.
R. J. Moses.
In: Water Needs for the Future, Nanda, V.P., ed., p 105-111, Westview Press, Boulder, Colorado, 1977.

Descriptors: *Colorado, *Water distribution(Applied), *Water requirements, *Water transfer, Water districts, Water importing, Water resources, Water supply development, Water allocation, Water users, Water supply.

Most of Colorado's internal water problems arise because Colorado is a rectangular state established without regard to river basin drainages. In Colorado, most of the people live east of the Continental Divide and most of the stream water runs on the west side of the Divide. The problems that have developed as a result of this situation and the solutions that have been evolving are analyzed. Originally, no legal obstacles barred transmountain water diversions designed to overcome the geographical quirks. Consequently, many private and public transmountain diversions were developed. In the 1930s, the trend away from wholesale transmountain diversions began. Now, the increased concern of western slope residents about the water supply inadequacies for western slope development will be a major obstacle to future major transmountain diversions. Increased environmental constraints pose an even greater threat to such diversions. The day of major transmountain diversions of water in Colorado has passed. It is unlikely that even those diversions on the drawing board for years will be built. (Coffey-Florida)
W79-09318

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

WATER POLLUTION,
I. Sloan.
In: Environment and the Law, p 19-30, Oceana Publications, Inc., Dobbs Ferry, New York 10522, 1979.

Descriptors: *Water pollution control, *Water pollution treatment, *Water pollution sources, *Water pollution effects, Water pollution, Water policy, Legislation, Water law, Wastes, Waste water(Pollution), Waste water treatment.

Until recently Americans have acted as though their rivers and lakes had an infinite capacity to absorb wastes. Pollution was considered the price of progress. Not until 1948 was comprehensive federal water pollution control legislation enacted. The first permanent legislation was not passed until 1956. The original overriding concern was with human health. Almost all state water pollution programs were carried out by State health departments. An in-depth historical analysis of the developing water pollution control effort by federal and state governments and an in-depth scientific analysis of the effects of water pollution and the results of wastes discharged into various water bodies are presented. Water pollution control legislation and programs have been broadened to encompass many environmental concerns, including recreation and aesthetics. Epidemics due to water borne causes are largely in the past. Our health efforts have moved to a more sophisticated concern for the effects of small amounts of toxic chemicals on humans and other life forms. (Coffey-Florida)
W79-09320

COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS (FINAL RULEMAKING).
Department of Energy, Washington, DC.
Federal Register, Vol 44, No. 46, p 12594-99, March 7, 1979.

Descriptors: *Floodplains, *Wetlands, *Protection, *Flood protection, Federal government, Regulation, Flood control, Flood damage, Flood plain insurance, Floods, Water table.

These regulations are issued pursuant to Executive Orders 11988 and 11990. Under these orders each federal agency must issue regulations or amend existing regulations to ensure consideration of floodplain and wetland protection. The Department of Energy (DOE) will take the following actions to ensure such protection: (1) avoid the long and short-term adverse impacts associated with wetland destruction; (2) avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative; (3) incorporate floodplain management and wetlands protection goals into the decision-making processes. These goals would include: (a) reducing the risk of flood loss; (b) minimizing the flood impact on human safety, health, and welfare; (c) restoring and preserving natural and beneficial values; (d) minimizing wetland destruction, loss, or degradation; (e) informing private participation parties of the flood-related hazards involved in any financial transaction related to a floodplain area; (4) undertake an evaluation of the potential effects of any DOE action; (5) implement alternative action to avoid adverse impacts; and (6) provide an opportunity for early public review of any plans for actions in floodplaining and wetland areas. (Coffey-Florida)
W79-09321

THE LAW OF THE SEA AND OCEAN RESOURCES,
T. Ishimine.
American Journal of Economics and Sociology, Vol. 37, No. 2, p 129-44, April, 1978.

Descriptors: *Law of the sea, *Oceans, *Resources development, Resources, Resource allocation, Foods, Fish, Fishing, Economics, Navigation, Navigable waters.

Recently, the nations began to recognize the ocean as an important resource source. The ocean's immense potential for providing food and nutrition particularly protein, began to be reexamined. The ocean also contains a seed of conflict among nations, because of overlapping claims to ocean resources. Attempts to establish the law of the sea have failed to reach an accord as to the definition of territorial waters and economic zones. At stake are freedom of navigation, fishing rights, and claims over mining deep seabed resources. The possible outcome of the law of the sea and ocean resources is examined to avoid scrambles among nations over the ocean resources. An in depth analysis is presented of the beginnings of this developing area of conflict in international law. Suggestions of the course to be followed and the considerations involved are discussed. (Coffey-Florida)
W79-09322

SETTLEMENT OF FISHERIES DISPUTES IN THE EXCLUSIVE ECONOMIC ZONE,
S. Rosenne.
American Journal of International Law, Vol. 73, No. 1, p 89-104, January, 1979.

Descriptors: *Law of the sea, *United nations, *Coasts, *International law, Resources, Resource allocation, Fisheries, International waters, Water law, Jurisdiction.

The question of the settlement of disputes as to the exercise of sovereign rights by a coastal state over the living resources of the exclusive economic zone is described as it evolved during the seventh session of the Third United Nations Conference on the Law of the Sea (UNCLOS III). Many important powers insist that the new convention contain adequate provisions for third-party settlement of disputes. During its first six sessions, UNCLOS III was concerned with establishing machinery for compulsory settlement of disputes arising under the new convention. Questions as to the attribution

of jurisdiction to that machinery were left for later consideration, after the outlines of the new substantive law of the sea became clearer. Article 296 of the Informal Composite Negotiating Text set forth limitations on the applicability of the compulsory dispute settlement provision. Out of session seven evolved a new formulation of article 296, intended to provide safeguards against another state's abuse of legal process. States are not more willing after the seventh session than they have been to entrust their sovereign rights to third-party settlement. (Coffey-Florida)
W79-09323

BOUNDARY WATERS CANOE AREA WILDERNESS ACT.
Public Law 95-495, secs 1 thru 21, 92 Stat 1649 (1978).

Descriptors: *Public lands, *Public access, *Water quality, Environmental control, Federal government, Wildlife, Public benefit, Legislation, Biological communities, Mineral industry, Recreation.

The purpose of the Boundary Waters Canoe Area Wilderness Act is to provide for such measures respecting the areas designated by the Boundary Waters Canoe Area Wilderness Act (Act)-the Boundary Waters Canoe Area Wilderness and Boundary Waters Canoe Area Mining Protection Area. The Act attempts to achieve the following: (1) provide for the protection and management of the fish and wildlife to enhance public enjoyment and appreciation of the region's unique biotic resources; (2) protect and enhance the natural value and environmental quality of the lakes, streams, shorelines and associated forest areas; (3) maintain high water quality; (4) minimize to the greatest extent possible the environmental impacts of mineral development; (5) prevent further road and commercial development and restore natural conditions to existing temporary roads; and (6) provide for the orderly and equitable transition from motorized recreational uses to nonmotorized uses on those lakes, streams, and portages where such mechanized uses are to be phased out under the Act's provisions. (Coffey-Florida)
W79-09324

THE 95TH CONGRESS: PARKS AND WILDERNESS,
K. Barton.
Environment, Vol. 20, No. 9, p 37-39, Nov. 1978.

Descriptors: *Wildlife conservation, *Parks, *Preservation, Wildlife, Environmental control, Environment, Environmental effects, Political constraints, Water policy, Federal government.

In the closing hours of the 95th Congressional session, the Boundary Water Canoe Area (BWCA) Wilderness bill was passed. BWCA is the largest wilderness east of the Rockies and the most heavily visited in the nation. It is located on the northeastern border of Minnesota. The million-acre BWCA is best known as the country's only lakeland wilderness, where canoeists can explore for days with almost no reminder of the world outside. Certain exceptions to the 1964 Wilderness Act made the BWCA a second-class wilderness, open to extensive motorboat use. For the past 15 years conservationists have been engaged in a bitter fight to protect the area. The BWCA bill passed and signed by the President settled the dispute. The new law embodies a compromise on the motorboat issue reluctantly agreed to by environmentalists. It cuts motor use in the BWCA to about half of the present use, and restricts motorboats primarily to lakes on the wilderness's periphery. Motor size is limited depending on the lake's characteristics, and motor use on some lakes will be phased out. Also, a major stretch of the BWCA on the Canadian border will be open to motor use until 1984. (Coffey-Florida)
W79-09325

OUTER CONTINENTAL SHELF (HOUSE REPORT NO. 95-590).
House Report No. 95-590 accompanying H.R. 1614, Outer Continental Shelf Committee, U.S. House, August 29, 1977.

Descriptors: *Continental shelf, *Oil fields, *Resources development, Federal government, State government, Oil pollution, Oil spills, Oil reservoirs, Oil, Environmental effects, Energy.

H.R. 1614 (Bill) will amend the 1953 Outer Continental Shelf Lands Act to provide a new statutory regime for the management of the oil and natural gas resources of the Outer Continental Shelf. The Bill will expedite the systematic development of the Shelf, while protecting our marine and coastal environment. The Bill's basic purpose is to promote the swift, orderly and efficient exploitation of our almost untapped domestic oil and gas resources in the Shelf. During the 1980's, oil and gas development on the Outer Continental Shelf is likely to be one of the single largest sources of additional domestic energy, at a lower development and impact cost than most alternatives. The Bill's other purposes are to: (1) improve provisions for lease administration; (2) require submission of exploration and development plans; (3) allow new exploration techniques; (4) provide for coordination with governors of effected states; (5) require baseline and monitoring studies; (6) require use of best available and safest technology where economically achievable; (7) reduce frivolous lawsuits by providing expeditious procedures for citizen's suits; (8) establish an offshore oil spill pollution fund; (9) provide grants to impacted states; and (10) establish fishermen's contingency fund. (Coffey-Florida)
W79-09327

CONSTRUCTION AND APPLICATION OF SECTION 23(B) OF FEDERAL POWER ACT, REQUIRING ANY PERSON INTENDING TO CONSTRUCT DAM OR PROJECT ON NON-NAVIGABLE STREAM TO FILE DECLARATION OF SUCH INTENTION,
M. A. DiSabatino.
40 A. L. R. Fed. 981-906 (1978).

Descriptors: *Federal power act, *Dam construction, *Project planning, *Non-navigable water, Water resources, Federal government, Public lands, Water law, Water policy, Navigable water, Federal jurisdiction, Dams.

The federal court cases which have construed the provision of Section 23(b) of the Federal Power Act are collected and analyzed. Section 23(b) requires one intending to construct a dam or other project works on a non-navigable stream, over which Congress has jurisdiction under its authority to regulate commerce, to file a declaration of such intention with the Federal Power Commission (FPC). The FPC will then decide whether the project will affect the interests of interstate or foreign commerce, in which case the project must be licensed by the FPC. Under Section 23(b), Congress vested in the FPC this power of licensing authority. The Federal Power Act supercedes state law, although Section 23 (b) provides that for projects not covered within the terms of the Act (compliance with state law is sufficient). In addition to its affect on state law, Section 23(b) must be reconciled with other Federal legislation concerning the development of water power. (Coffey-Florida)
W79-09328

WATER POLICY: BATTLE OVER BENEFITS,
A. Pelham.
Congressional Quarterly Weekly Report, Vol. 36, No. 9, p 565-74, March 4, 1978.

Descriptors: *Project benefits, *Political aspects, *Project planning, *Federal project policy, Water policy, Dams, Dikes, Channels, Political constraints, Cost-benefit analysis, Federal budget, Financial feasibility.

Though there have been some changes over the past few years, Congress has retained a close relationship with the major construction agencies - the U.S. Army Corps of Engineers, the Interior Department's Bureau of Reclamation, the Soil Conservation Service in the Agriculture Department and the Tennessee Valley Authority - that build the dams, levees, canals, reservoirs and channels. Congress continues to have the advantage in most water disputes with whatever administration is in office. In deciding which of the many proposed projects to authorize and fund, Congress has developed over the years what is referred to as the 'buddy system', or 'congressional courtesy'. Efforts to reform water policy have sought to minimize the influence of individual members on individual projects, by placing greater emphasis on the national benefits from projects funded with federal tax revenues. The Congressional system of water projects development is analyzed as to: (1) questions raised by the system; (2) the authorization process; (3) the appropriation process; and (4) the Grandfather clauses. A cost-benefit analysis approach is presented. The local community's role in the process is considered. A perspective on the prospects for change is given. (Coffey-Florida)
W79-09329

ENFORCEMENT OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 TO CONTROL NONPOINT SOURCE POLLUTION,
W. C. Wicker.
Land Water Law Review, Vol. 14, No. 2, p 419-46, 1979.

Descriptors: *Federal water pollution control act, *Pollution abatement, *Water pollution sources, Federal government, Agricultural runoff, Industrial wastes, Municipal wastes, Environmental control, State government, Local governments.

Point source water pollution is a recognized problem. The nation has taken great strides in efforts to control industrial and municipal water pollution. The battle has barely begun in the effort to control pollution from agriculture or other nonpoint pollution sources (NPS). The major vehicle for the control of water pollution is the 1972 Federal Water Pollution Control Act Amendments. The only provision of the Act that deals directly with the NPS problem is Section 208. Because a statute's effectiveness extends only as far as its enforcement capabilities, the enforcement of Section 208 as related to the implementation of NPS controls are discussed. Three levels of enforcement are discussed: (1) enforcement by the Environmental Protection Agency; (2) enforcement through the citizen's suit; and (3) enforcement at the state and local level. Unless some legislative changes are made such as either more enforcement power or more financial aid for implementation, the control of nonpoint source pollution will not be achieved. (Coffey-Florida)
W79-09330

6F. Nonstructural Alternatives

POTENTIAL NONSTRUCTURAL OR LOW COST WATERWAYS SYSTEM IMPROVEMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
F. M. Anklam.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A044 343, Price codes: A07 in paper copy, A01 in microfiche. Miscellaneous Paper 0-71-1, June 1971. 148 p, 3 fig, 2 tab, 56 ref, 7 append.

Descriptors: *Mississippi River, *Ohio River, *Missouri River, *Inland waterways, *St Lawrence Seaway, *Rivers, *Navigation, *Louisiana, *Missouri, Locks, Dams, Barges, Costs, Economics, Cost analysis, Non-structural alternatives, Planning, Navigable waters, *Welland Canal(Canada), Waterway transportation, Waterway system improvements, Towing industry.

The inland waterways system of the United States, as it exists today, has a number of problems associated with near-capacity traffic conditions. In many places on the Mississippi, Ohio, and Missouri Rivers and their navigable tributaries, there are serious impediments to the free flow of waterborne commerce. This study was conducted to determine

the potential for more efficient utilization of existing inland waterways resources and facilities as a possible alternative to heavy investment in major construction. The study was based on distribution of a questionnaire, meetings and discussions with the Civil Works Task Group for Inland Waterways Systems Analysis, and visits to Corps of Engineers Civil Works offices and river sites by the author. The inland waterways system is an intimate interweaving of three significant subsystems: the physical waterway, the towing industry, and the commodities. These subsystems and their interrelations were discussed in detail. It was determined that there are a number of areas of potential for improvement in the inland waterways system. These areas involve such items as changes in operating procedures of the locks, revisions of the operating rules for towboats approaching and using locks, staffing considerations, additional assistance at heavily trafficked locks, and other such factors. The following two examples illustrate possible improvements. The study of the Welland Canal in the Canadian portion of the St. Lawrence Seaway was a most productive effort. Through improved management of both the lock system and the shipping in the canal, major investments were delayed while significant increases in ship passage were realized. Also, at the industrial canal in New Orleans, Louisiana, and in recent tests at Lock and Dam 26 on the Mississippi River near St. Louis, Missouri, the use of extra towboats to assist long tows through the locks was very productive. In the Lock and Dam 26 tests, an estimated $100,000 in time-saving benefits was realized by the towing industry for a $26,000 cost. It was concluded that there is considerable evidence that significantly more traffic can be passed through our inland waterways system through the medium of nonstructural or low cost modifications in operating rules, lock operations, and facilities. This will enable the Civil Works Directorate to apply capital improvement investment more effectively at the places where it is the only solution while materially increasing our capability to pass increased traffic at other locations for considerable periods of time. (Sims-ISWS)
W79-09131

INTERRELATING LAND AND WATER MANAGEMENT IN FLORIDA,
For primary bibliographic entry see Field 6E.
W79-09176

ALTERNATIVES TO APPROPRIATION LAW,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 6E.
W79-09315

COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS (FINAL RULEMAKING).
Department of Energy, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-09321

6G. Ecologic Impact Of Water Development

BYZANTINE DRAINAGE LAW: PENNSYLVANIA'S EXPERIENCE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 6E.
W79-09183

7. RESOURCES DATA

7A. Network Design

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-09169

7B. Data Acquisition

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS,
Texas A and M Univ., College Station. Remote Sensing Center.
B. J. Blanchard, and W. Bausch.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-18482, Price codes: A04 in paper copy, A01 in microfiche. Final Report RSC 3273, January 1978. 57 p, 7 fig, 8 tab, 5 ref, 1 append. NASA NAS5-22534.

Descriptors: *Remote sensing, *Rainfall-runoff relationships, *Watersheds(Basins), Satellites(Artificial), Runoff, Moisture content, Soils, Vegetation, Arid lands, Rainfall, Data processing, Analytical techniques, LANDSAT, Multispectral scanner.

A system or technique that could provide a measurement of the interacting characteristics of the surface and near-surface condition would allow improvement in the estimates of runoff. A previous study had been directed toward classification of the runoff potential of watershed surfaces by use of linear combinations of spectral data from the Multi-Spectral Scanner (MSS). Some encouraging results were obtained using data over 20 watersheds in a two-county area located in central Oklahoma. The original objective of this study was to modify and test the concept of using linear equations of MSS data for the prediction of runoff coefficients for use with the commonly used Soil Conservation Service (SCS) watershed runoff equation. It appears that the predominant factor influencing the classification of watershed runoff curve numbers is the difference in soil color and its associated reflectance when dry. In regions where vegetation grows throughout the year, where wet surface conditions prevail or where watersheds are timbered, there is little hope of classifying runoff potential with visible light alone. (Sims-ISWS)
W79-09134

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME I--EXECUTIVE SUMMARY.
IBM Corp., NY.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-25264, Price codes: A02 in paper copy, A01 in microfiche. Final Report, IBM No. 75W-00056, NASA-CR-143858, 1975. 21 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Remote sensing, *River forecasting, *Model studies, Mathematical models, Computer models, Runoff, Storage, Water storage, Rivers, Floods, Streamflow, Watersheds(Basins), Computer programs, Analytical techniques, Hydrographs, Hydrology.

A computer-based simulation model was adapted to a streamflow forecasting application and implemented in an IBM System/360 Model 44 computer, operating in a dedicated mode, with operator interactive control through a Model 2250 keyboard/graphic CRT terminal. The test site whose hydrologic behavior was simulated is a small basin (365 square kilometers) designated 'Town Creek near Geraldine, Alabama'. This watershed had been modeled in previous studies, and determination of several of its parameters through remote sensing had been found feasible. Operation of the model was demonstrated in February 1975, meeting the primary study objective. A description of the NASA-IBM streamflow forecast model, adequate to instruct another user in its operation, appears in Volume II of this report, in satisfaction of the secondary study objective. (Sims-ISWS)
W79-09143

FORESTRY, GEOLOGY AND HYDROLOGICAL INVESTIGATIONS FROM ERTS-1 IMAGERY IN TWO AREAS OF ECUADOR, SOUTH AMERICA,
Junta Nacional de Planification, Quito (Ecuador).
N. V. Moreno.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-26614, Price codes: A02 in paper copy, A01 in microfiche. Final Report, November 1973. 40 p, 6 fig, 1 tab.

Descriptors: *Remote sensing, *Satellites(Artificial), *Aircraft, *South America, Photography, Aerial photography, Forestry, Forests, Geology, Hydrology, Soil moisture, Tropical regions, Foreign research, *Ecuador, *Guayas River Basin(Ecuador), *Oriente River Basin(Ecuador), ERTS.

Despite heavy cloud cover, ERTS-1 imagery of Ecuador has proved to be exceedingly useful for several types of natural resource interpretations. Using cloud-free portions of ERTS imagery in the Oriente and Guayas River basin areas of the country, investigations were conducted in forestry, geology, and hydrology. Based on the work in forestry, it was found that in the Oriente area, well drained forests containing commercially valuable hardwoods can be recognized confidently and delineated quickly on the ERTS imagery. The work in geology in the Oriente area led to the following conclusions: that even in the tropical rainforest ERTS can provide an abundance of inferential information about large-scale geologic structures (e.g., the major fractures that seem to control several of the oil fields); that ERTS imagery is better than normal aerial photography for recognizing linears in this area; and that working iteratively among ERTS images, photo mosaics, and 1:400,000 photography provides a vital link for extracting the maximum amount of information from each type of imagery and for training interpreters, who are accustomed to standard photography, how to use ERTS imagery. From the work in hydrology, it was concluded that monitoring and control of annual inundation of portions of the Guayas River Basin would be greatly aided by repeated ERTS coverage during the period January through May each year. In this connection, the imagery is particularly useful for updating the changes in distributary channels and estimating the numbers and types of civil works necessary to control flooding. (Sims-ISWS)
W79-09147

LABORATORY MEASUREMENTS OF UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF CALVERT, BALL, JORDAN, AND FELDSPAR SOIL SEDIMENTS,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
C. H. Whitlock, J. W. Usry, W. G. Witte, and E. A. Gurganus.
NASA Technical Paper 1039, December 1977. 33 p, 13 fig, 12 ref.

Descriptors: *Remote sensing, *Sediments, *Laboratory tests, Soils, Soil types, Reflectance, Equipment, Analytical techniques, Spectrometers, Sedimentology, Marine sediments, Spectral radiance, Nonpoint pollution sources.

A limited effort to investigate the potential of remote sensing for monitoring nonpoint source pollution was conducted. Spectral reflectance characteristics for 4 types of soil sediments were measured for mixture concentrations between 4 and 173 ppm. For measurements at a spectral resolution of 32 nm, the spectral reflectances of Calvert, Ball, Jordan, and Feldspar soil sediments were distinctly different over the wavelength range from 400 to 980 nm at each concentration tested. At high concentrations, spectral differences between the various sediments could be detected by measurements with a spectral resolution of 160 nm. At a low concentration (4 ppm), only small differences were observed between the various sediments when measurements were made with 160-nm spectral resolution. Radiance levels generally varied in a nonlinear manner with sediment concentration; linearity occurred in special cases, depending on sediment type, concentration range, and wavelength. (Sims-ISWS)
W79-09150

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitets vensen, Oslo.

For primary bibliographic entry see Field 2C.
W79-09152

ACOUSTIC EMISSION AS AN INDICATION OF STABILITY DECREASE IN FRACTURE ZONES OF AVALANCHES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
For primary bibliographic entry see Field 2C.
W79-09155

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-09169

DEVELOPMENT OF A COMPUTER BASED FLOOD FORECASTING SYSTEM FOR AUSTRALIA,
Bureau of Meteorology, Melbourne (Australia).
A. J. Hall, and J. F. Elliott.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, 24-26 October, 1978. Convened by the International Institute for Applied Systems Analysis (Laxenburg, Austria). 23 p, 1 fig, 6 tab, 5 ref.

Descriptors: *Flood forecasting, *Computers, *Computer programs, Hydrologic data, Operations research, Cost-benefit analysis, Regions, Data collection, Real-time, Hydrologic modeling, Meteorology, Automation, Data processing, Australia, Mathematical models.

Operational flood forecasting in Australia is the responsibility of the Bureau of Meteorology. As part of a planned automation and improvement of meteorological forecast services, a network of mini-computer systems is being proposed for installation in each of the main Regional Forecast Centers. This paper endeavors to show the complexities in developing a computer-based flood forecasting service for a large region. Outlined are considerations necessary in properly specifying the hardware requirements and the design of the combination of computer programs and data files to match the computer-based system to the operation requirement. Discussed are details such as the raw data quantities and the treatment of this data. The system will operate over a wide range of catchments and thus function on various levels of instrumentation and hydrologic sophistication. Emphasized is flexibility within the design, especially in regard to the structure of the hydrologic modeling component. The system involves data collection on a large scale, real time hydrologic modeling, and forecast dissemination to the public. A fairly superficial cost-benefit analysis suggests that the introduction of a computer-based flood forecasting system as part of a computer-based national weather service would have considerable economic advantage over an existing manual forecasting service. (See also W79-09285) (Bell-Graf--Cornell)
W79-09286

7C. Evaluation, Processing and Publication

GEOHYDROLOGY OF COMAL, SAN MARCOS, AND HUECO SPRINGS.
Texas Department of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-09139

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1971-SEPTEMBER 1975,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2J.
W79-09140

8. ENGINEERING WORKS

8A. Structures

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,
Corps of Engineers, Washington, DC. Beach Erosion Board.
For primary bibliographic entry see Field 2L.
W79-09138

8B. Hydraulics

HYDRAULIC BEHAVIOR OF AN UNCONFINED AQUIFER,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
S. N. Webb, and K. K. Watson.
Australian Water Resources Council Technical Paper No. 38, 1979. 65 p, 25 fig, 2 tab, 15 ref, 1 append. Australian Government Publishing Service, Canberra. 75/85.

Descriptors: *Hydraulic properties, *Aquifers, *Aquifer characteristics, Hydraulic models, Testing, Fluid mechanics, Pumping, Aquifer testing, Drawdown, Discharge measurement, Discharge(Water), New South Wales, Australia.

The hydraulic behavior of a typical unconfined aquifer was studied by instrumenting the core of depression formed during a pumping test with a rapid-response pressure measuring system. The Botany Bay and Georges River Basin in New South Wales was the site of the study. Regional geology and environmental factors are discussed. A 0.20 m bore was equipped with a submersible turbines pump; ten piezometers were located deep in the aquifer; additional pressure sensors were installed progressively as more became known about the behavior of the aquifer. Pump test data are summarized for the eight constant discharge pump tests. Careful analysis showed that the aquifer was not homogeneous and isotropic as initially assumed. Drawdown behavior indicated that two layers of fine material influenced the response of the aquifer. The aquifer at the field site was shown to be leaky and consists of three zones: an unconfined upper zone lying above 7.7 m depth, contributing very little to the discharge from the bore; a zone from 7.7 m to 17 m depth contributing to the bore discharge by leaking through an impeding layer at about 17 m depth; and a semi-confined aquifer lying below 17 m depth. Included is an annotated bibliography on water movement in unconfined aquifers. (Schaefer-IPA)
W79-09083

DESIGN FOR HARBOR ENTRANCE IMPROVEMENTS, WELLS HARBOR, MAINE; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. R. Bottin, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 272, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-78-18, November 1978. 84 p, 8 tab, 41 photos, 5 pl, 6 ref.

Descriptors: *Harbors, *Hydraulic models, *Waves(Water), *Wells Harbor, Maine.

A 1:50-scale (undistorted) hydraulic model of Wells Harbor, Maine, which included the entrance to the harbor, the shoreline south and north of the harbor, and sufficient offshore area to permit generation of required test waves, was used to investigate the effects of proposed improvements at the harbor entrance on wave action. Proposed improvement plans consisted of installation of stone spur dikes in the jettied entrance and a breakwater attached to existing north jetty. A 20-ft-long wave generator, a model circulation system, and an automated data acquisition and control system (ADACS) were utilized. Results: During moderate to large wave attack, existing harbor entrance experiences hazardous navigation conditions due to breaking waves and interaction of waves with tidal currents. Originally proposed spur-dike configuration (plan 1) will slightly increase wave heights in outer entrance (gage 1), will have little effect on wave heights between outer entrance and the bend in the jetties, and will reduce wave heights through remainder of jettied entrance. Changing spur-dike cross sections at entrance (plan 2) will not reduce wave heights there. Installing a breakwater (plan 3) will substantially improve wave conditions in jettied entrance over those for existing conditions or any spur-dike plan tested. (WES)
W79-09092

NAVIGATION CONDITIONS IN ALEXANDRIA REACH, RED RIVER NAVIGATION PROJECT, LOUISIANA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
L. J. Shows, and J. J. Franco.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A064 397, Price codes: A06 in paper copy, A01 in microfiche. Technical Report H-78-24, December 1978. 97 p, 9 tab, 17 photos, 37 pl.

Descriptors: *Navigation, *Hydraulic models, *Alexandria Reach, *Red River Waterway(LA), *Fixed-bed models.

Alexandria Reach is a section of the Red River approximately 87.3 miles upstream of the junction of the Red and Mississippi Rivers. There are five bridges in the reach within a distance of less than 2 miles. A fixed-bed model reproducing about 3.5 miles of the river in the vicinity of Alexandria, Louisiana, to an undistorted scale of 1:100 was used to determine navigation conditions through the reach and to develop modifications to eliminate any adverse conditions. The model investigation was concerned principally with navigation conditions approaching and through the bridges. Results indicate: With existing conditions, navigation through the reach will tend to be hazardous, particularly for downbound tows because of the arrangement and limited width of the navigation spans, the channel and current alignment approaching the bridges, and high-velocity currents. Navigation conditions through the reach with the existing bridges can be improved by modifying the revetment along the left bank in the cutoff and just downstream of the cutoff, excavating the right bank between the two upper bridges, excavating and adding a dike along the left bank upstream of the U. S. Highway 165 Bridge, and adding submerged dikes along the right bank. (WES)
W79-09095

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

CONTROL OF TOXIC EFFLUENTS AND MANAGEMENT OF TOXIC BOTTOM SEDIMENTS,
Water Quality Bureau (Japan). Water Quality Management Div.
T. Hayashi.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 1-9, 1978. 4 tab.

Descriptors: *Water quality control, *Water quality standards, *Mercury, *Polychlorinated biphenyls, *Bioaccumulation, *Japan, Poisons, Heavy metals, Path of pollutants, Water chemistry, Bottom sediments, Chemical wastes, Industrial wastes, Waste disposal, Chemical analysis.

In recent years, the decline in Japanese water quality has ceased and there has been a trend toward slow recovery. This is due to the rigorous control of effluents throughout the country in recent years. This paper explains the water pollution control measures designed to regulate the discharge of toxic substances and treat bottom

sediments containing toxic substances. The control of mercury and PCB contamination is emphasized. (See also W79-09113) (Deal-EIS)
W79-09114

9D. Grants, Contracts, and Research Act Allotments

CONTROL OF TOXIC EFFLUENTS AND MANAGEMENT OF TOXIC BOTTOM SEDIMENTS,
Water Quality Bureau (Japan). Water Quality Management Div.
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W79-09114

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For primary bibliographic entry see Field 2C.
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Colorado Univ., Nederland. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W79-09135

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 21
NOVEMBER 1, 1979

W79-09331 -- W79-09580
CODEN: SWRABW

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 21
NOVEMBER 1, 1979

W79-09331 -- W79-09580

e Secretary of the U.S. Department of the Interior has de-
mined that the publication of the periodical is necessary in the
nsaction of the public business required by law of this Depart-
ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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SYMPOSIUM ON THE PHYSICS AND CHEMISTRY OF ICE,
For primary bibliographic entry see Field 2C.
W79-09342

THE DISTORTION OF A WATER MOLECULE IN ICE,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
E. Whalley.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 13-31, 1978. 2 fig, 1 tab, 65 ref.

Descriptors: *Water properties, *Ice, *Reviews, *Water structure, Water, Condensation, Freezing, Water vapor, Crystals, Molecular structure, Hydrogen bonding, Electrical properties, Mathematical models, Polarity, Refractivity, Properties, Water molecule, Potential energy.

The experimental evidence for the distortion of a water molecule when it is condensed to form ice was reviewed. The specific distortions considered are the changes in inter-nuclear distances, energy and its derivatives with respect to nuclear motion, and electrical moments and polarizabilities and their response to nuclear motion. Some of the properties of ice can be expanded as Fourier or Taylor series in the ratio r/R of the O-H to the O-O distances, and these expansions were used to relate various properties of the intermolecular potential energy, of the electrical dipole moments, and of the polarizability. For example, the amplitude of the orientation polarization can be related to the infrared intensity of the fundamental and first overtone infrared bands. The principal conclusion from this paper was that many of the molecular properties of ice can be correlated by expanding them in the displacement of the in-phase vibration. (See also W79-09342) (Humphreys-ISWS)
W79-09343

CLATHRATE ICES--RECENT RESULTS,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
For primary bibliographic entry see Field 2C.
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X-RAY DETERMINATION OF THE STRUCTURE OF ICE IV,
California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
For primary bibliographic entry see Field 2C.
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ORIGIN OF THE HIGH-FREQUENCY TRANSLATIONAL BANDS OF ICE I,
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For primary bibliographic entry see Field 2C.
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THE TRANSLATIONAL LATTICE-VIBRATION RAMAN SPECTRUM OF SINGLE-CRYSTAL ICE IH,
Centre Univ. de Savoie, Chambery (France). Lab. de Spectrometrie Raman-Laser.
For primary bibliographic entry see Field 2C.
W79-09347

CONFIGURATIONAL STATISTICS,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Physics.
For primary bibliographic entry see Field 2C.
W79-09348

VACANCIES IN PURE ICE STUDIED BY POSITRON ANNIHILATION TECHNIQUES,
Risoe National Lab., Roskilde (Denmark). Dept. of Chemistry.
For primary bibliographic entry see Field 2C.
W79-09349

VACANCIES IN HF-DOPED AND IN IRRADIATED ICE BY POSITRON ANNIHILATION TECHNIQUES,
Risoe National Lab., Roskilde (Denmark). Dept. of Chemistry.
For primary bibliographic entry see Field 2C.
W79-09350

INTERACTION OF POINT DEFECTS IN ICE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkorperphysik.
For primary bibliographic entry see Field 2C.
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THEORETICAL MODELS FOR INTERPRETING THE DIELECTRIC BEHAVIOUR OF HF-DOPED ICE,
Handsworth Grammar School, Birmingham (England).
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ELECTRICAL CONDUCTIVITY AND RELAXATION IN ICE CRYSTALS WITH KNOWN IMPURITY CONTENT,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2C.
W79-09353

EFFECT OF PRESSURE ON THE DIELECTRIC PROPERTIES OF ICE IH SINGLE CRYSTALS DOPED WITH NH3 AND HF,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festokoerperphysik.
For primary bibliographic entry see Field 2C.
W79-09354

ELECTRICAL BEHAVIOUR OF FINELY DIVIDED ICE,
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For primary bibliographic entry see Field 2C.
W79-09355

THE ELECTRICAL PROPERTIES OF ICE SURFACES,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W79-09356

DIELECTRIC PROPERTIES OF DISLOCATION-FREE ICE,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
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MEASUREMENTS OF THE ELECTRICAL PROPERTIES OF ICE IH SINGLE CRYSTALS BY ADMITTANCE AND THERMALLY STIMULATED DEPOLARIZATION TECHNIQUES,
Modena Univ. (Italy).
For primary bibliographic entry see Field 2C.
W79-09358

INELASTIC NEUTRON SCATTERING FROM ICE AND OTHER PROTON-CONTAINING SUBSTANCES,
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For primary bibliographic entry see Field 2C.
W79-09359

THERMAL CONDUCTIVITY OF ICE IN THE TEMPERATURE RANGE 0.5 TO 5.0 K,
CEA Centre d'Etudes Nucleaires de Grenoble (France). Service des Basses Temperatures.
For primary bibliographic entry see Field 2C.
W79-09360

RADIATION DAMAGE IN ICE AT LOW TEMPERATURES STUDIED BY PROTON CHANNELLING,
Neuchatel Univ. (Switzerland). Inst. de Physique.
For primary bibliographic entry see Field 2C.
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THE ORIENTATION POLARIZATION IN HEXAGONAL ICE PARALLEL AND PERPENDICULAR TO THE C-AXIS,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W79-09362

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Stuttgart Univ. (Germany, F.R.). Physikalisches Inst.
For primary bibliographic entry see Field 2C.
W79-09363

CO2 IN NATURAL ICE,
Bern Univ. (Switzerland). Physikalisches Inst.
For primary bibliographic entry see Field 2C.
W79-09364

THE RADIO-FREQUENCY BIREFRINGENCE OF POLAR ICE,
Scott Polar Research Inst., Cambridge (England).
For primary bibliographic entry see Field 2C.
W79-09365

DIELECTRIC PERMITTIVITY OF GLACIER ICE MEASURED IN SITU BY RADAR WIDE-ANGLE REFLECTION,
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W79-09367

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Birmingham Univ. (England). Dept. of Physics.
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W79-09368

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Institut National des Sciences Appliquees, Lyon (France). Groupe d'Etudes de Metallurgie Physique et de Physique des Materiaux.
For primary bibliographic entry see Field 2C.
W79-09369

INELASTIC BEHAVIOUR OF ICE IH SINGLE CRYSTALS IN THE LOW-FREQUENCY RANGE DUE TO DISLOCATIONS,
Institut National des Sciences Appliques, Lyon (France). Groupe d'Etudes de Metallurgie Physique et de Physique des Materiaux.
For primary bibliographic entry see Field 2C.
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Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W79-09373

A DEFORMATION MECHANISM MAP OF ICE,
Hokkaido Univ., Sapporo (Japan). Dept. of Applied Physics.
For primary bibliographic entry see Field 2C.
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Birmingham (England). Dept. of Physics.
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W79-09375

DEFORMATION OF ICE SINGLE CRYSTALS CLOSE TO THE MELTING POINT,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W79-09376

SHORT-TERM RHEOLOGY OF POLYCRYSTALLINE ICE,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
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W79-09377

THE EFFECT OF ANISOTROPY ON THE CREEP OF POLYCRYSTALLINE ICE,
Melbourne Univ., Parkville (Australia). Dept. of Meteorology.
For primary bibliographic entry see Field 2C.
W79-09378

THE INFLUENCE OF ICE-CRYSTAL SIZE ON CREEP,
Wisconsin Univ.-River Falls. Dept. of Plant and Earth Sciences.
For primary bibliographic entry see Field 2C.
W79-09379

THE CREEP OF NACL-DOPED ICE MONOCRYSTALS,
Birmingham Univ. (England). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 2C.
W79-09380

ON THE RELATIONSHIPS BETWEEN LOW-DENSITY AMORPHOUS SOLID WATER AND ICE IH,
Chicago Univ., IL. Dept. of Chemistry; and Chicago Univ., IL. James Frank Inst.
For primary bibliographic entry see Field 2C.
W79-09381

DYNAMICAL PROCESSES AT THE ICE-WATER INTERFACE DURING SOLIDIFICATION,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festokoerperphysik.
For primary bibliographic entry see Field 2C.
W79-09382

CHARGE SEPARATION BY COLLISION OF ICE PARTICLES ON METALS: ELECTRONIC SURFACE STATES,
Eidgenoessische Inst. fuer Schneeund Lawinenforschung, Davos (Switzerland).
For primary bibliographic entry see Field 2C.
W79-09383

OPTICAL ABSORPTION SPECTRA OF H2O ICE DOPED WITH YTTERBIUM CHLORIDE YBCL3,
Centre National de la Recherche Scientifique, Orsay (France). Lab. Aime Cotton.
For primary bibliographic entry see Field 2C.
W79-09384

MOLECULAR ORBITAL CALCULATIONS OF WATER-ICE SURFACE INTERACTIONS,
Missouri Univ.-Rolla. Dept. of Physics.
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FRAZIL NUCLEATION MECHANISMS,
Wheeling Coll., WV. Dept. of Physics.
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W79-09386

STRUCTURE AND BEHAVIOUR OF GRAIN BOUNDARIES IN POLYCRYSTALLINE ICE,
Hokkaido Univ., Sapporo (Japan). Dept. of Applied Physics.
For primary bibliographic entry see Field 2C.
W79-09387

CRYSTALLOGRAPHIC STRUCTURE OF POLYCRYSTALLINE ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W79-09388

REGELATION AND THE DEFORMATION OF WET SNOW,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W79-09391

THERMAL GROUND-WATER DISCHARGE AND ASSOCIATED CONVECTIVE HEAT FLUX, BRUNEAU-GRAND VIEW AREA, SOUTHWEST IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young, R. E. Lewis, and R. L. Backsen.
Geological Survey Water-Resources Investigations 79-62 (open-file report), May 1979. 17 p, 1 fig, 1 plate, 2 tab, 9 ref.

Descriptors: *Geothermal studies, *Thermal springs, *Withdrawal, *Irrigation wells, *Well data, Water temperature, Water yield, Water levels, Heat transfer, Convection, *Southwest Idaho.

The Bruneau-Grand View area occupies about 1,100 square miles in southwest Idaho. The area has a rural population dependent on ground-water irrigation. Temperature of the ground water ranges from 15 C to more than 80 C. Ground water for irrigation is obtained from flowing and pumped wells. Discharge of thermal ground water from 104 irrigation wells and from 5 hot springs in 1978 was about 50,500 acre-feet. Convective heat flux from the geothermal system associated with this discharge was 4.97 x 10 to the 7th power calories per second. (Woodard-USGS)
W79-09403

GEOPRESSURE IN THE CARRIZO-WILCOX AQUIFER SYSTEM OF TEXAS,
Geological Survey, NSTL Station, MS. Water Resources Div.
J. B. Wesselman.
In: Proceedings of the Third Geopressured-Geothermal Energy Conference, Vol. 1, University of Southwestern Louisiana, Lafayette, Louisiana, p GI-425 - GI-438, November 16-18, 1977. 2 fig, 8 tab. Published by University of Southwestern Louisiana, Lafayette, Louisiana.

Descriptors: Hydrogeology, *Tertiary period, *Gulf Coastal Plain, *Texas, *Groundwater barriers, *Geochemistry, Cenozoic Era, Structural geology, Depth, Water pressure, Earth pressure, Aquifers, Confined water, Maps, *Geopressure, *Carrizo-Wilcox aquifer system.

The normally pressured Carrizo-Wilcox aquifer system in Texas terminates downdip in a major growth-fault system. The faults are rooted in geopressured sediments of Cretaceous and Tertiary age and trend subparallel to the Texas coast. The fault system continues into Mexico and Louisiana. The top of the geopressured zone occurs in the lowermost sediments of the Carrizo-Wilcox aquifer system at the updip edge of the growth-fault system. All Carrizo-Wilcox sediments are geopressured 6 to 30 miles downdip from this juncture. Ground water moves or has moved from the geopressured sediments through the fault system into the normally pressured aquifers. Zones of relatively fresh, warmer-than-normal water, which originated in the geopressured sediments, are present in normally pressured aquifers more than 10 miles updip from any geopressured Carrizo-Wilcox sediments. The depth to the geopressured zone varies with the gross lithologic character and formation geometry of the sediments. The top of the geopressured zone is downwarped where large sand bodies drain water from the geopressured sediments and upwarped where the sand bodies are absent or discontinuous. (Woodard-USGS)
W79-09409

USE OF HYDROGEOLOGIC MAPPING TECHNIQUES IN IDENTIFYING POTENTIAL GEOPRESSURED-GEOTHERMAL RESERVOIRS IN THE LOWER RIO GRANDE EMBAYMENT, TEXAS,
Geological Survey, NSTL Station, MS. Water Resources Div.
R. H. Wallace, Jr., R. E. Taylor, and J. B. Wesselman.
In: Proceedings of the Third Geopressured-Geothermal Energy Conference, Vol. 1, University of Southwestern Louisiana, Lafayette, Louisiana, GI-1 - GI-88, November 16-18, 1977. 9 fig, 6 tab, 50 ref. Published by University of Southwestern Louisiana, Lafayette, Louisiana.

Descriptors: *Hydrogeology, *Subsurface mapping, *Gulf Coastal Plain, *Texas, *Geothermal studies, Structural geology, Isotherms, Salinity, High pressure, Thermal conductivity, Heat transfer, Confined water, Methane, Natural gas, Oil, Exploration, Geochemistry, Diagenesis, Underground storage, Borehole geophysics, *Geopressured-geothermal energy, *Alternate energy resources, *Rio Grande embayment, Computer techniques.

Hydrogeologic maps presented in this report were prepared to assist those seeking to assess geopressured-geothermal energy resources; to understand origin, migration, and accumulation of hydrocarbons; and to safely manage the underground storage of liquid wastes in the Gulf Coast area. Variations in altitude of fluid-pressure gradient, temperature, and salinity surfaces within the geologic framework are shown by means of depth contours for a part of the lower Rio Grande embayment, Texas. About 1,000 well logs provided the data base for this study. Pressure, temperature, and salinity maps reflect variations in physical and chemical characteristics of subsurface fluids, mainly water, with depth. Interpretations based on this knowledge provide valuable insight into hydrologic, hydrodynamic, and hydrochemical processes occurring within the geologic framework of deep, young, sedimentary basins. The geologic framework, especially formation geometry, determines avenues and rates of fluid movement. Gross lithologic changes appear as broad upwarps or downwarps of the pressure, temperature, and salinity surfaces. Localized highs and lows on these surfaces near fault traces usually represent upward discharge of compaction effluents from greater depths along faults. (Woodard-USGS)
W79-09410

2. WATER CYCLE

2A. General

REMOTE SENSING APPLICATIONS TO HYDROLOGIC MODELING IN THE SOUTHERN SIERRA NEVADA AND PORTIONS OF THE SAN JOAQUIN VALLEY, VOL. I,
California Univ., Santa Barbara. Dept. of Geography.
For primary bibliographic entry see Field 7B.
W79-09422

STUDY OF WATER RESOURCES WITH THE AID OF SPACECRAFT IN THE UNITED STATES,
For primary bibliographic entry see Field 7B.
W79-09501

2B. Precipitation

SCPP FORECASTING SUPPORT, INTERIM PROGRESS REPORT, VOL. II (EXPERIMENTAL DAY SUMMARIES) FOR PERIOD 1 DECEMBER 1978 - 30 JUNE 1979,
Electronic Techniques, Inc., Fort Collins, CO.
J. O. Rhea, and J. L. Le Compte.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 498, Price codes: A12 in paper copy, A01 in microfiche. July 1979. Prepared for U.S. Department of Interior, Bureau of Reclamation Office of Atmospheric Resources Management, Denver, CO. 273 p, 218 fig, 3 tab. 9-07-85-V0021.

Descriptors: *Forecasting, *Weather forecasting, *Sierra Cooperative Pilot Project, Rawinsondes, Precipitation(Atmospheric), Meteorology, Data collections, Satellites(Artificial), Aircraft, Condensation, Temperature, Remote sensing, Wind velocity, Weather data, Weather patterns.

A summary of field services performed and analyses completed to date by Electronic Techniques, Inc. (ETI) for the Sierra Cooperative Pilot Project is presented in this two volume work. Volume II is comprised exclusively of a discussion of conditions for each priority I and II experimental day, as well as the heavy precipitation day of January 11, 1979. Information for each day includes a discussion time sections of Sheridan rawinsondes, Blue Canyon hourly precipitation, aircraft flight period, synoptic maps, satellite pictures, and plotted rawinsondes bracketing the flight period. Statistics indicated: (1) high skill in forecasting precipitation in 12 hour blocks out to 24 hours; (2) at 700 millibars wind direction is more predictable than wind speed; and (3) skill in delineating large from small precipitation amounts for the first 24 hours was good. Findings included: (1) moderate to high positive linear correlation between successive 3-hourly values of precipitable water vapor, summations of condensate supply rate, water vapor flux, temperature, and wind direction and speed; (2) better precipitation predictions for Blue Canyon through use of the past 3-hour value; (3) cooler temperatures and severely backed low level winds at Sheridan; and (4) poor predictability in moisture variables at Sheridan. (Schaefer-IPA)
W79-09421

RESERVATION DROUGHT IMPACT SURVEY,
South Dakota Univ., Vermillion. Business Research Bureau.
H. Wilde, and C. A. Kent.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 677, Price codes: A04 in paper copy, A01 in microfiche. Prepared for The United Sioux Tribes Development Corporation, January 12, 1977. 59 p, 4 fig, 29 tab.

Descriptors: *Droughts, *Environmental effects, *Water shortage, *Economic impact, *Sioux Reservations, Agriculture, Livestock, Precipitation(Atmospheric), Rainfall, South Dakota, Stock water, Productivity.

Drought impact data gathered from mail out questionnaires on seven Sioux Reservations is presented. The extent and magnitude of the drought is illustrated in tabular form listing Reservation locations, normal precipitation, and precipitation variance from normal for 1973 through 1976. For 1976 all of the Reservations experienced below average precipitation. The deficiency range was from almost 4 inches on the Cheyenne River to over 15 inches for the Sisseton-Wahpeton Sioux. Survey data were used to estimate current and projected economic losses due to the drought. Economic losses are reflected in crop losses, livestock losses, reduced rental incomes, and employment losses. Short, intermediate, and long term solutions to the drought impacts are discussed. Solutions outlined include: range conservation programs, water development programs, assistance to tribal governments, a moratorium on loan repayments, emergency employment programs, farm management programs, adjustments of lease terms, and additional funding programs. It is concluded that the drought has almost dealt a death blow to Reservation agriculture. Without substantial help, the potential which agriculture presents as a viable way of life for tribal members may be gone. (Seigler-IPA)
W79-09427

THE SCIENTIFIC PLANNING AND ORGANIZATION OF PRECIPITATION ENHANCEMENT EXPERIMENTS, WITH PARTICULAR ATTENTION TO AGRICULTURAL NEEDS,
World Meteorological Organization, Geneva (Switzerland).
Maybank, Jr.
Publication No. 478, Technical Note No. 154, 1977. 104 p, 2 fig, 3 tab, 103 ref.

Descriptors: *Cloud seeding, *Weather modification, *Rainfall augmentation, *Agricultural engineering, *Precipitation(Atmospheric), Meteorology, Droughts, Storms, Rainfall, Water vapor, Climatology, Clouds, Crops, Winds, Hail.

The probable steps to be taken in a typical endeavor to ascertain the potential for rain augmentation in a region for which additional precipitation might be desired are outlined. The principles, past performance, and present problems connected with cloud seeding are summarized, and the steps to be taken in determining the specific needs for additional water are given. These steps are primarily related to agricultural usage as it is in this area that the greatest general potential for rain augmentation lies. Activities for determining the atmospheric water resources and potential for augmentation are discussed. It is generally necessary to investigate the potential for cloud seeding by means of a carefully designed experiment and to proceed to a full-scale rain-increase operation only if success can be demonstrated from the experiment. Various statistical designs are considered, and the problems that are met in the planning stages are discussed. Experimental details and costs for an idealized but reasonably typical cloud-seeding experiment are outlined. The evaluation steps that follow a completed experiment are described, together with consideration of further action if the results warrant future cloud-seeding operations. (Seigler-IPA)
W79-09434

SIERRA COOPERATIVE PILOT PROJECT, 1977-78 DATA INVENTORY, PROJECT SKYWATER.
Bureau of Reclamation, Denver, CO. Office of Atmospheric Resources Management.
For primary bibliographic entry see Field 7B.
W79-09438

PROJECT SKYWATER: SKYWATER CONFERENCE X REPORT. THE SIERRA COOPERATIVE PILOT PROJECT DESIGN,
North American Weather Consultants, Goleta, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 529, Price codes: A16 in paper copy, A01 in microfiche. Conference held June 22-23, 1978, South Lake Tahoe. 1979. 359 p, 83 fig, 25 tab, 1 append. 7-07-83-V0008.

Descriptors: *Weather modification, *Cloud seeding, *Project Skywater, Precipitation(Atmospheric), Cloud physics, Meteorology, Environmental effects, Rainfall-runoff relationships, Economic impact, Model studies, Social impact, Instrumentation, Water resources development.

The proceedings from the Skywater X Conference are reported. The conference was sponsored by the Bureau of Reclamation to discuss the status of preliminary studies and design work performed for the Sierra Cooperative Pilot Project (SCPP), a part of the Skywater Program. The overall project goal is the development of an effective weather modification technology, that is scientifically and socially acceptable, for precipitation management to serve a portion of the country's water needs. SCPP is studying the physical processes of precipitation formation to identify those conditions that provide the best potential for winter precipitation augmentation in the Sierra Nevada. Objectives include: improving current operational cloud seeding methods, transferring the techniques and results to concerned groups, and enhancing public confidence in their use. Topics of discussion at the conference included: environmental impact, the Sierra Ecology Project, preliminary project design, meteorological support measurements, and radar and aircraft data collection and analysis. Detailed presentation were given on the proposed design for SCPP continuation including extended areas of effect, tracers and contamination, and hypotheses. (Seigler-IPA)
W79-09474

OBSERVATIONS AND NUMERICAL SIMULATIONS OF PRECIPITATION MECHANISMS IN NATURAL AND SEEDED CONVECTIVE CLOUDS,
Chicago Univ., IL. Dept. of Geophysical Sciences.
L. D. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 301, Price codes: A10 in paper copy, A01 in microfiche. Technical Note No. 54, UCHI-CPL-79-54, March 1979. Doctoral Dissertation, 204 p, 55 fig, 8 tab, 61 ref.

Descriptors: *Mathematical models, *Precipitation(Atmospheric), *Cloud seeding, *Weather modification, Numerical analysis, Convection, Clouds, Rain, Hail, Meteorology, High Plains, Cloud physics, Climatology, Microphysics.

A numerical model was developed to assess the potential effects of artificial ice-phase seeding agents on precipitation development, rainfall, and hailfall in isolated summertime convective clouds. The model was successfully compared to radar and aircraft data of several natural clouds in differeent geographical locations. The model was specifically used to study seeding agents, rates, and evaluation techniques for potential use at the Bureau of Reclamation's High Plains Cooperative Program Miles City, Montana, field site. Various problems in technology transfer of seeding techniques from the High Plains region to other areas are discussed. The model was used to assess the effects of AgI and CO2 seeding on rainfall and hailfall processes and amounts at various sites around the world. Major model results indicate: (1) a strong coupling and feedback between ice-phase and liquid-phase microphysics, (2) natural clouds can be divided into two microphysical types, (3) these types tend to respond in opposite ways to attainable seeding rates of artificial ice-phase seeding agents, (4) rainfall and hailfall are generally positively coupled, (5) dry ice is the preferred agent for High Plain summertime seeding, and (6) hail suppression and rain augmentation techniques are not directly transferable from one area to another. (Seigler-IPA)
W79-09482

2C. Snow, Ice, and Frost

SYMPOSIUM ON THE PHYSICS AND CHEMISTRY OF ICE,

Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, 1978. 716 p. Glen, J. W., Adie, R. J., Johnson, D. M., Homer, D. R., and MacQueen, A. D., editors. Published by the International Glaciological Society, Cambridge (England).

Descriptors: *Ice, *Snow, *Crystallography, *Conferences, *Reviews, Physical properties, Physics, Chemistry, Electrical properties, Crystals, Thermal conductivity, Deformation, Nucleation, Mechanical properties, Frazil ice, Boundary processes, Ice-water interfaces, Creep, X-Ray diffraction, X-Ray analysis, Dielectric properties, Polycrystalline ice, Regelation.

The symposium objectives were to provide a review of progress in various branches of ice physics and chemistry since the last symposium (1972) and to report on recent and topical work. The broad subject areas covered included physical properties of ice, crystallography, ice structure, polycrystalline ice, snow, and electrical properties of ice. (See W79-09343 thru W79-09393) (Humphreys-ISWS)
W79-09342

THE DISTORTION OF A WATER MOLECULE IN ICE,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
For primary bibliographic entry see Field 1A.
W79-09343

CLATHRATE ICES--RECENT RESULTS,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
D. W. Davidson, and J. A. Ripmeester.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 33-49, 1978. 13 fig, 4 tab, 35 ref.

Descriptors: *Clathrates, *Ice, *Water structure, *Hydrates, Natural gas, Movement, Properties, Electrical properties, Crystals, Crystallography, Propane, Data collections, Water molecule, Gas hydrates, Methane, Ethane, Isobutane, Neopentane.

The last five years (1972-1977) have seen an increasing interest in clathrate ices as a result of the discovery of extensive deposits of natural gas hydrates in permafrost regions. Twenty-six new clathrate hydrates have been identified, mainly by NMR, including a tetragonal hydrate of dimethyl ether. N-butane and neopentane have been found to be enclathrated in natural gas hydrates, the former as a gauche conformer. As a result of their high symmetries, encaged neopentane, CF4, SF6, and SeF6 exhibit a resing apparent-phase-change effect in the temperature range of NMR line narrowing. There is increasing evidence that reorientational jumps of water molecules are more frequent than translational jumps in clathrate ices. This is certainly so for ethylene oxide-d4 and tetrahydrofuran-d8 hydrates, for which two regions of proton line narrowing and two T sub t rho minima have been observed. The reorientational motions of most guest molecules in structure II hydrates only become isotropic on a time scale long enough to permit the cage configurations to be averaged to 43m symmetry by reorientation of the water molecules. The orientations of the water molecules remain disordered to the lowest temperatures. (See also W79-09342) (Humphreys-ISWS)
W79-09344

X-RAY DETERMINATION OF THE STRUCTURE OF ICE IV,
California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
H. Engelhardt, and B. Kamb.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 51-53, 1978. 2 fig, 1 tab, 4 ref.

Descriptors: *Ice, *X-ray analysis, *Hydrogen bonding, Structure, Molecular structure, Least squares method, X-rays, Bonding, Metastable ice, Ice IV, Water molecule.

Ice IV, a wholly metastable ice phase, has a structure based on a framework of tetrahedrally hydrogen-bonded water molecules in a rhombohedral unit cell. The structure involves two non-equivalent types of water molecules and four non-equivalent types of hydrogen bonds. A novel structural feature is a hydrogen bond that passes through the center of a 6-ring of water molecules and links non-adjacent structural layers. The bond network is proton-disordered, even after quenching. (See also W79-09342) (Humphreys-ISWS)
W79-09345

ORIGIN OF THE HIGH-FREQUENCY TRANSLATIONAL BANDS OF ICE I,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
D. D. Klug, and E. Whalley.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 55-63, 1978. 5 fig, 1 tab, 25 ref.

Descriptors: *Ice, *Structure, *Theoretical analysis, Hydrogen bonding, Vibrations, Mathematical models, Frequency, Refractivity, Anisotropy, Polarity, Analytical techniques, Ice I, High frequency.

The translational vibrations of hypothetical ordered forms of ice Ic and ice Ih have been predicted and correlated with the known spectra of the actual disordered phases. The TO-LO splittings were predicted by assuming that the changes of mean refractive indexes across the translational band is the same in all phases and equal to the known change for ice Ih. Both ordered phases were predicted to have LO components at c. 275 and c. 310/cm. These predicted bands are assumed to be related to the bands at the same frequencies in the disordered phases. These bands are, therefore, LO components corresponding to the TO translational vibrations. (See also W79-09342) (Humphreys-ISWS)
W79-09346

THE TRANSLATIONAL LATTICE-VIBRATION RAMAN SPECTRUM OF SINGLE-CRYSTAL ICE IH,
Centre Univ. de Savoie, Chambery (France). Lab. de Spectrometrie Raman-Laser.
P. Faure, and A. Chosson.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 65-72, 1978. 3 fig, 2 tab, 20 ref.

Descriptors: *Ice, *Hydrogen bonding, *Polarographic analysis, *Structure, Crystals, Spectrophotometry, Vibrations, Frequency, Analytical techniques, Measurement, Laboratory tests, Properties, Crystallography, Ice Ih, Monocrystals.

Presented were the Raman spectra in natural and polarized light of ice Ih monocrystals in the region of the translational frequencies. These spectra are of better quality and higher resolution than previous spectra from monocrystals, and they demonstrate the value of the investigation of single crystals by this technique, in spite of the proton disorder. In order to explain the observations, the authors used the model of simultaneous activity of the modes allowed in D sub sigma h symmetry and the modes allowed by the proton disorder. By analogy with the interpretation of the phenomena observed in ordered piezoelectric crystals, it was suggested that the existence of translation frequencies up to c. 320/cm is due to the splitting between transverse and longitudinal optical modes. On this basis, an initial simple dynamical model using only three parameters permits an interpretation of the Raman spectrum. The probable presence of directional effects in ice Ih argues in favor of the proposed explanation. (See also W79-09342) (Humphreys-ISWS)
W79-09347

CONFIGURATIONAL STATISTICS,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Physics.
J. F. Nagle.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 73-83, 1978. 40 ref. NSF DMR 72-03203-A02.

Descriptors: *Ice, *Electrical properties, *Statistical models, *Reviews, Mathematical models, Theoretical analysis, Statistics, Electrical conductance, Crystals, Molecular structure, Crystallography, Analytical techniques, Polarity, Dielectric constant, Polarization factor.

Theories of the dielectric constant in ice differ in three fundamentally different ways that are often confused with each other. First, there is the choice of interactions to include in the model, notably whether to try to include long-range dipolar interactions as in the Kirkwood theory or to include only the short-range ice-rule interactions. Second, there is the choice of the kind of statistical quantity calculated, e.g., the Kirkwood correlation factor g or the polarization factor G, which Stillinger and Cotter showed to be different. Finally, there is the choice of the kind of computational tool used, and in original papers this choice often obscures the first two differences. With these distinctions in mind, a review was given of current theoretical calculations of the dielectric constant and the residual entropy and how the different theories relate to each other and to experiments. (See also W79-09342) (Humphreys-ISWS)
W79-09348

VACANCIES IN PURE ICE STUDIED BY POSITRON ANNIHILATION TECHNIQUES,
Risoe National Lab., Roskilde (Denmark). Dept. of Chemistry.
O. E. Mogensen, and M. Eldrup.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 85-99, 1978. 5 fig, 27 ref.

Descriptors: *Ice, *Voids, *Crystals, *Electrical properties, Theoretical analysis, Analytical techniques, Mathematical models, Laboratory tests, Measurement, Methodology, Crystallography, Temperature, Hydrogen bonds, Monocrystals, Positron annihilation.

Positron annihilation techniques (PAT) were briefly discussed, and the information that may be obtained about the positronium (Ps) states was compared to that obtainable about the similar electron states. The behavior of Ps in monocrystals of pure light and heavy ice was studied at temperatures between -185 C and the melting point. Ps is very probably trapped in vacancies (i.e., missing water molecules) in ice. A vacancy formation energy of roughly 0.2-0.35 eV was derived in agreement with the value 0.28 + or - 0.07 eV obtained previously from studies of the annealing of irradiated ice. The vacancy concentration is at least a few parts per million at the melting point, i.e., roughly 10,000 times higher than normally assumed in the literature. The fact that the vacancy concentration is comparable to that of the hydrogen-bond defects will probably enforce a pronounced change in the 'hydrogen-bond-defects' theory of the electric properties of ice. (See also W79-09342) (Humphreys-ISWS)
W79-09349

VACANCIES IN HF-DOPED AND IN IRRADIATED ICE BY POSITRON ANNIHILATION TECHNIQUES,
Risoe National Lab., Roskilde (Denmark). Dept. of Chemistry.
M. Eldrup, O. E. Mogensen, and J. H. Bilgram.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16,

1977. Journal of Glaciology, Vol. 21, No. 85, p 101-113, 1978. 4 fig, 33 ref.

Descriptors: *Ice, *Voids, *Crystals, Radioisotopes, Irradiation, Analytical techniques, Laboratory tests, Measurement, Analysis, Cooling, Properties, Crystallography, Heating, Fluorides, Positron annihilation, Monocrystals, Doped ice, Polycrystalline ice, Hydrogen fluoride.

Positron annihilation techniques, which are specifically sensitive to vacancy-type defects, were used to study the effect on ice of irradiation and HF doping. Main conclusions are that immobile water-molecule vacancies can be created at low temperatures by either irradiation or HF doping. Upon heating, the vacancies become mobile at about 100 K. Some of them cluster into di- and multi-vacancies which grow in size with temperature up to at least 145 K. A vacancy migration energy of 0.34 + or - 0.07 eV is deduced, about three times higher than previously assumed. Possible mechanisms for vacancy formation by HF doping were discussed. Out-diffusion of HF is followed at -26 C over several weeks. The diffusion constant derived agrees within uncertainty (a factor of two) with the large value obtained by Haltenorth and Klinger. In particular, two results seem important for other parts of ice physics. One is that HF doping creates an appreciable increase in the vacancy concentration, the influence of which should be considered in models for other defects in ice. The other is that vacancies migrate at about 100 K, a fact which might be important for the interpretation of some of the many 'anomalous' effects observed in ice at about that temperature. (See also W79-09342) (Humphreys-ISWS)
W79-09350

INTERACTION OF POINT DEFECTS IN ICE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkorperphysik.
J. H. Bilgram, and H. Granicher.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 115-122, 1978. 6 ref.

Descriptors: *Ice, *Physical properties, *Crystals, Analytical techniques, Crystallography, Ions, Mathematical models, Analysis, Frequency, Properties, Structure, Chemistry, Temperature, Conductivity, Diffusion, Fluorides, Dissociation, Dielectric constants, Water molecule, Hydrogen fluoride.

The interaction of point defects in ice has been neglected for a long time. Experimental data obtained from dielectric measurements on HF-doped crystals stimulated a new evaluation of the possibility of an interaction between Bjerrum defects and ions. In a previous paper it has been shown that this leads us to assume the existence of aggregates of Bjerrum defects and ions. In this paper, these aggregates and Bjerrum defects were used to explain the dielectric properties of ice, especially the temperature dependence of the product of the high and low frequency conductivity. The interaction of Bjerrum defects and impurity molecules leads to a dependence of the concentration of Frenkel pairs on Bjerrum-defect concentration. At HF concentrations above the native Bjerrum-defect concentration, the formation of a Frenkel pair is enhanced. This leads to the fast out-diffusion which has been studied in highly doped crystals by means of NMR techniques. (See also W79-09342) (Humphreys-ISWS)
W79-09351

THEORETICAL MODELS FOR INTERPRETING THE DIELECTRIC BEHAVIOUR OF HF-DOPED ICE,
Handsworth Grammar School, Birmingham (England).
G. C. Camplin, J. W. Glen, and J. G. Paren.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 123-141, 1978. 8 fig, 6 tab, 19 ref.

Descriptors: *Ice, *Model studies, *Electrical properties, *Theoretical analysis, Crystals, Crystallography, Conductivity, Mathematical models, Temperature, Analytical techniques, Data collections, Analysis, Laboratory tests, Statistical methods, Conductivity, Fluorides, Ice dissociations, Monocrystals, Doped ice, Dielectric constants, Hydrogen fluoride.

To understand the recent dielectric measurements made on HF-doped ice single crystals requires a full knowledge of the concentration of electrical defects present in ice and their subsequent interactions. Previous interpretations of the behavior of HF-doped ice have concentrated upon specific features in isolation, whereas this paper presented analyses of a data set of 139 temperature and impurity combinations from 17 HF-doped ice single crystals. The interpretation of the behavior of these crystals is in terms of several possible theoretical models. All models are based upon the common assumptions that HF molecules enter the ice lattice substitutionally and that excess Bjerrum and ionic defects can be formed at the HF sites. They also use the theory of electrical conduction in ice and the defect equilibria analysis in ice. All models yield values for the concentration, mobility, energy of formation, and charges for the different types of electrical defect considered to be generated. Using the derived defect conductivities and the Jaccard theory of electrical conduction, the relaxation time of HF-doped ice was successfully predicted over a wide range of temperature and fluoride concentration. (See also W79-09342) (Humphreys-ISWS)
W79-09352

ELECTRICAL CONDUCTIVITY AND RELAXATION IN ICE CRYSTALS WITH KNOWN IMPURITY CONTENT,
New Mexico Inst. of Mining and Technology, Socorro.
G. W. Gross, I. C. Hayslip, and R. N. Hoy.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 143-160, 1978. 15 fig, 1 tab, 35 ref. ONR NR082-094. NSF ATM 74-19379.

Descriptors: *Ice, *Electrical properties, *Crystallography, *Model studies, Crystals, Conductivity, Polarity, Laboratory tests, Electrical conductance, Chlorides, Analysis, Dispersion, Measurement, Analytical techniques, Methodology, Monocrystals.

Three-terminal dielectric bridge measurements (in the range 20 Hz to 100 kHz between -5 C and -90 to -120 C) were made of ice doped with (1) conductivity-enhancing ionic impurities (HCl, HF, NaCl, KF, NH4F) and (2) conductivity-depressing solutes (NH4OH, NH4 Cl, NH5CO3, NaHCO3). Blocking electrodes were used for the first group. The true ice parameters were extracted from linearized plots of the Debye equations. Chlorides and fluorides showed very similar characteristics in their spectra and static conductivity. The results suggested that static conductivity is controlled by extrinsic protons. On the other hand, bases, or solutes that impart a positive freezing potential to the ice, suppress extrinsic protons. In this case, the static conductivity was not, or only weakly, temperature dependent and lower than in the first group. A conductivity cross-over was observed in neither case. The dielectric conductivity contribution is strongly dependent on impurity concentration but apparently less affected than the static conductivity by the nature of the solute. The principal relaxation time is reduced by most solutes, exceptions are pure (bicarbonate-free) bases, sodium bicarbonate, and carbon dioxide. (See also W79-09342) (Humphreys-ISWS)
W79-09353

EFFECT OF PRESSURE ON THE DIELECTRIC PROPERTIES OF ICE IH SINGLE CRYSTALS DOPED WITH NH3 AND HF,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festokoerperphysik.
M. Hubmann.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 161-172, 1978. 5 fig, 23 ref.

Descriptors: *Ice, *Electrical properties, *Crystals, *Crystallography, Laboratory tests, Conductivity, Pressure, Electrical conductance, Ammonia, Effects, Sampling, Testing procedures, Measurement, Electrical impedance, Temperature, Mathematical models, Chemistry, Dispersion, Analysis, Analytical techniques, Monocrystals, Hydrogen fluoride, Dielectric constant, Doped ice.

This paper described measurements of the dielectric constant and of the conductivity on pure and doped ice single crystals subjected to hydrostatic pressure. The dopants used were NH3 or HF. The pressure and temperature ranges covered were 1 to 1,500 bar and -15 to -60 C. The activation volumes for the orientational and the ionic contribution to the conductivity could be determined. A definitive interpretation was not possible because many questions concerning the formation of the defects are still open. In addition to the main subject, some new data from conductivity measurements on NH3-doped single crystals at atmospheric pressure were presented. (See also W79-09342) (Humphreys-ISWS)
W79-09354

ELECTRICAL BEHAVIOUR OF FINELY DIVIDED ICE,
British Antarctic Survey, Cambridge (England).
J. G. Paren, and J. W. Glen.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 173-191, 1978. 8 fig, 5 tab, 22 ref.

Descriptors: *Ice, *Electrical properties, *Model studies, *Crystals, Mathematical models, Crystallography, Sampling, Laboratory tests, Carbon dioxide, Analysis, Analytical techniques, Adsorption, Conductivity, Effects, Dispersion, Data collections, Temperature, Frequency, Monocrystals, Finely divided ice, Polar ice.

The electrical behavior of ice which has been finely ground and compressed was investigated during ageing in air and over a range of temperatures. The dielectric behavior may be accurately represented as the sum of two elliptical relaxation spectra. The behavior eventually stabilizes with similar activation energies for the mean relaxation time of each spectrum c. 0.25 eV, and the ratio of the relaxation times is 10 in samples of density c. 0.42 Mg/cu m. Arguments were presented on whether the higher-frequency dispersion is a consequence of the heterogeneous nature of the samples or is a bulk relaxation process. The similarities between the behavior of such finely ground ice and of deposited snow and polar glacier ice were discussed. The extent to which the results may be attributed to surface adsorption of CO2 was examined by reference to measurements of the CO2 content of finely divided ice and ice from polar regions. Measurements are needed of specific surface area and of CO2 levels in ice, snow, and firn to explore the extent to which the present scatter in CO2 data is due to experimental uncertainties. Above all, electrical studies should be undertaken on monocrystals of ice containing carbonic acid and on finely-divided doped ice. (See also W79-09342) (Humphreys-ISWS)
W79-09355

THE ELECTRICAL PROPERTIES OF ICE SURFACES,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
N. Maeno, and H. Nishimura.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 193-205, 1978. 9 fig, 15 ref.

Descriptors: *Ice, *Electrical properties, *Crystallography, *Boundary processes, Conductivity,

Surfaces, Boundaries(Surfaces), Temperature, Electric fields, Laboratory tests, Testing procedures, Effects, Sublimation, Fluorides, Analysis, Analytical techniques, Monocrystals, Monocrystalline ice, Surface conductivity, Hydrogen fluoride.

The surface conductivity of monocrystalline ice was measured as a function of temperature, impurity concentration, field-strength, and other variables. At temperatures below about -6 C, the surface conductivity was found to follow the Arrhenius equation with an activation energy of 33 + or - 2 kcal/mol (1.43 + or - 0.09 eV). Small amounts of impurities contained within the ice increased the surface conductivity and decreased the activation energy: for HF-doped ice the activation energy was reduced to 10.0 kcal/mol (0-44 eV). Mechanical treatment of the ice surface increased the surface conduction. At temperatures above about -6 C the surface conductivity increased more rapidly with the rise in temperature; this is explained in terms of the appearance and development of a quasi-liquid layer on the ice surface. The electrical behavior of sublimed ice surfaces was found to vary at a temperature around -9 C. At higher temperatures a sharp, instantaneous current increase was observed as evacuation began; this was considered to be caused by the formation of ionic states due to the rapid evaporation of quasi-liquid layers. It was concluded that the temperature above which the ice surface was covered with a quasi-liquid layer lay in the range -6 to -9 C. (See also W79-09342) (Humphreys-ISWS)
W79-09356

DIELECTRIC PROPERTIES OF DISLOCATION-FREE ICE,
Army Terrestrial Sciences Center, Hanover, NH.
K. Itagaki.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 207-217, 1978. 9 fig, 1 tab, 20 ref, 1 append.

Descriptors: *Ice, *Electrical properties, *Crystals, *Boundary processes, Laboratory tests, Testing procedures, Frost, Data collections, Boundaries(Surfaces), Analysis, Analytical techniques, Frequency, Surfaces, Conductance, Electric fields, Monocrystals, Dielectric constants.

Dielectric properties of dislocation-free hoar-frost ice crystals were measured in the audio-frequency range. Anomalously small relaxation strength was found in the dislocation-free area of the crystal samples, while dislocations deliberately introduced by scratching the samples drastically modified the relaxation strength. Since measurements made in the area of high dislocation density indicated normal behavior, electrically charged dislocations are considered to be the source of the normally observed dielectric relaxation. (See also W79-09342) (Humphreys-ISWS)
W79-09357

MEASUREMENTS OF THE ELECTRICAL PROPERTIES OF ICE IH SINGLE CRYSTALS BY ADMITTANCE AND THERMALLY STIMULATED DEPOLARIZATION TECHNIQUES,
Modena Univ. (Italy).
A. Loria, E. Mazzega, U. Del Pennino, and G. Andreotti.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 219-230, 1978. 5 fig, 21 ref.

Descriptors: *Ice, *Electrical properties, *Crystals, *Boundaries(Surfaces), Laboratory tests, Analytical techniques, Analysis, Mathematical models, Conductivity, Testing procedures, Electric fields, Electric currents, Measurements, Temperature, Frequency, Ice Ih, Monocrystals, Monocrystalline ice.

Ice Ih single crystals were investigated by complex admittance and thermally stimulated depolarization (TSD) techniques in the relaxation-time ranges 0.00001 to 10s and 10 to 10,000s, respectively. The relaxation spectrum was resolved, and three components were studied. Second-order kinetics had to be assumed for two of the TSD spectra to obtain Arrhenius-type relaxation times. The 'Debye spectrum' had an activation energy for the relaxation time of 0.64 eV at the high temperatures, and its dielectric strength revealed a possible defect cross-over at T = 190 K. Far below this temperature, the activation energy was 0.38 eV, that is about half of that necessary for a pair of ion defects to form. In comparison with the results of other authors, a lower concentration of ionic defects, or possibly of Bjerrum-ion aggregates, was deduced to occur in these crystals. Inert-gas host molecules were proposed as a possible origin of the two other spectra, having relaxation times shorter than the 'Debye spectrum' and energies of 0.33 eV and 0.37 eV. Moreover the 0.33 eV spectrum, whose dielectric strength appears at a temperature below T, might alternatively be related to the cross-over of the 'Debye spectrum'. The TSD technique seems to give results similar to those obtained by dielectric relaxation measurements, provided that, in certain cases, one assumes a depolarization kinetics different from that shown to be valid at the higher temperatures in frequency-dependent measurements. Further experimental investigations and a careful analysis of the thermally stimulated depolarization kinetics in real ice crystals will be necessary to clarify this discrepancy. (See also W79-09342) (Humphreys-ISWS)
W79-09358

INELASTIC NEUTRON SCATTERING FROM ICE AND OTHER PROTON-CONTAINING SUBSTANCES,
Institut Max von Laue-Paul Langevin, Grenoble (France). Centre de Tri.
B. Dorner.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 231-240, 1978. 7 fig, 23 ref.

Descriptors: *Ice, *Neutron activation analysis, *Crystals, Analysis, Analytical techniques, Diffusion, Theoretical analysis, Mathematical models, Structure, Laboratory tests, Measurement, *Neutron scattering, Ice Ih, Protons.

A brief introduction to neutron scattering was given, with special emphasis on the difference between coherent and incoherent contributions. The report of recent work on ice contained the determination and verification of some phonon dispersion curves, and it outlined the state of the art on diffuse scattering due to the proton disorder. Results on 'two-dimensional ice' in copper formate tetrahydrate are of great interest as this system exhibits a phase transformation below which the protons are ordered. The study of rotational diffusion and of the tunnel splitting of the rotational ground state of molecules which contain protons was discussed in some detail. These investigations are now possible with very high energy resolution. Delta E approximately 5 x 10 to the minus 8th power eV (0.0004/cm or 12 MHz). (See also W79-09342) (Humphreys-ISWS)
W79-09359

THERMAL CONDUCTIVITY OF ICE IN THE TEMPERATURE RANGE 0.5 TO 5.0 K,
CEA Centre d'Etudes Nucleaires de Grenoble (France). Service des Basses Temperatures.
M. Varrot, G. Rochas, and J. Klinger.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 241-245, 1978. 2 fig, 3 ref.

Descriptors: *Ice, *Thermal conductivity, *Laboratory tests, Crystals, Temperature, Measurement, Mathematical models, Analysis, Analytical techniques, Thermal properties, Methodology, Testing procedures, Heat flow.

A method was described for measuring the thermal conductivity of ice in the temperature range from 0.5 to 5.0 K using a 3He apparatus. The results from the first experiments were not too far from the theoretical law for the low-temperature thermal conductivity of ice lambda = 0.42 Tau. Measurements at still lower temperatures are necessary to confirm the results. (See also W79-09342) (Humphreys-ISWS)
W79-09360

RADIATION DAMAGE IN ICE AT LOW TEMPERATURES STUDIED BY PROTON CHANNELLING,
Neuchatel Univ. (Switzerland). Inst. de Physique.
I. Golecki, and C. Jaccard.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 247-258, 1978. 4 fig, 25 ref.

Descriptors: *Ice, *Radiation, *Crystallography, Laboratory tests, Temperature, Irradiation, Testing procedures, Crystals, Measurement, Structure, Analysis, Analytical techniques, Proton channelling, Low temperature, Monocrystals.

In the reported study, 100 keV protons with fluxes between 3 x 10 to the 15th power and 3 x 10 to the 16th power/sq m/s and in doses up to 4 x 10 to the 20th power/sq m were used in ice between -191 C and -87 C to create damage and to analyze it. The Rutherford backscattering minimum yield along the c-axis (about 0.05 in good monocrystals) increases up to unity with the dose, according to a function which can be scaled by a 0.17 + or - 0.04 eV above -185 C). Higher flux produces more damage above -180 C, but less below. A beam in a random direction is more efficient below -180 C, but less at higher temperature than an aligned beam. Beam-induced reordering was observed at definite temperatures and doses. The damage was shown to be due to energy loss by electronic excitations, which decay and produce disordered molecule clusters, mainly by incoherent aggregation of vacancies and interstitials. (See also W79-09342) (Humphreys-ISWS)
W79-09361

THE ORIENTATION POLARIZATION IN HEXAGONAL ICE PARALLEL AND PERPENDICULAR TO THE C-AXIS,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
G. P. Johari, and S. J. Jones.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 259-276, 1978. 9 fig, 3 tab, 39 ref.

Descriptors: *Ice, *Polarity, *Electrical properties, *Crystallography, Electric fields, Frequency, Energy, Crystals, Laboratory tests, Testing procedures, Temperature, Measurement, Sampling, Instrumentation, Aging(Physical), Analytical techniques, Analysis, Data collections, Monocrystals, Permittivity, Dielectric constants.

The relative permittivity and loss of zone-refined single crystals of hexagonal ice were measured in the temperature range 200-271 K and frequency range 0.5 Hz-0.2 MHz, using brass, stainless steel, and gold-foil electrodes. The c-axis of the crystal was oriented parallel to the electric field in 14 samples, and perpendicular to the field in 8 samples. The equilibrium relative permittivity of orientation polarization, epsilon sub o, parallel and perpendicular to the c-axis, is 96.5 + or - 1, and the average relaxation time tau is 36 microseconds at 265.5 + or - 0.5 K; epsilon sub o = 124 + or - 1.5 and tau = 30 ms, at 210 K. The magnitude of the orientation polarization obeys the Curie-Weiss equation with T sub o = 15 + or - 2 K for both orientations. These values are in contrast with the c. 17% difference in epsilon sub o for the two orientations reported in the literature. The extrapolated limiting high-frequency relative permittivity epsilon sub infinity, measured for both the orientations, is indistinguishable within 0.5%. The logarithmic plot of the product of tau and temperature against the reciprocal temperature is linear in the range 210-271 K and gives an activation energy

and a pre-exponential factor of 51 + or - 2 kJ/mol and 0.93 + or - 0.22 ps K respectively, for both the orientations of the c-axis with respect to the electric field. The decrease in activation energy which has been reported to occur in polycrystalline ice and in single crystal ice near 230 K is not found until a temperature of 210 K. Single crystals of ice stored in the dielectric cell, after the completion of measurements, for periods ranging from 1-11 weeks at 253 + or - 2 K showed no change in their epsilon sub o, tau, epsilon sub infinity that could be attributed to the effect of ageing on the orientation polarization. (See also W79-09342) (Humphreys-ISWS)
W79-09362

THE INFLUENCE OF THE RATE OF DEFORMATION ON THE ELECTRICAL PROPERTIES OF ICE MONOCRYSTALS,
Stuttgart Univ. (Germany, F.R.). Physikalisches Inst.
G. Noll.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 277-289, 1978. 8 fig, 1 tab, 19 ref.

Descriptors: *Ice, *Electrical properties, *Mechanical properties, *Crystallography, Deformation, Plastic deformation, Conductivity, Electrical conductance, Electric fields, Shear, Strain, Rates, Analysis, Analytical techniques, Compressibility, Aging(Physical), Laboratory tests, Instrumentation, Testing procedures, Measurement, Monocrystals, Dielectric constants, Permittivity.

The influence of plastic deformation on the electrical properties of ice monocrystals was measured in the frequency range 0.01 to 100,000 Hz as a function of strain-rate and strain. The crystals were tested mainly under uniaxial compression, their orientation being for glide in the basal glide system (0001) (1120). The resolved shear strain-rate ranged from 0.00002 to 0.001/s, and the resolved shear strain ranged from 3 to 60%. Transient as well as bridge methods were used for the electrical measurements before, during, and after the deformation. Plastic deformation reduces the electrical conductivity in the space-charge dispersion range. The decrease depends strongly on the strain-rate; the size of the strain has practically no influence. After the end of the deformation, recovery processes were observed, which restored the original conductivity if the total strain was small. Rapid and large deformations, however, leave permanent changes. The changes of the d.c. conductivity and of the dispersion strength in the space-charge region were discussed and attributed to the increase of the dislocation density and the change of character of the dislocation network. (See also W79-09342) (Humphreys-ISWS)
W79-09363

CO2 IN NATURAL ICE,
Bern Univ. (Switzerland). Physikalisches Inst.
B. Stauffer, and W. Berner.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 291-300, 1978. 3 fig, 5 tab, 18 ref.

Descriptors: *Ice, *Carbon dioxide, *Snow, *Gases, Laboratory tests, Testing procedures, Instrumentation, Measurement, Hail, Alkalinity, Hydrogen ion concentration, Analysis, Analytical techniques, Data collections, Dissolved gases.

Natural ice contains approximately 100 ppm (by weight) of enclosed air. This air is mainly located in bubbles. Carbon dioxide is an exception. The fraction of CO2 present in bubbles was estimated to be only about 20%. The remaining part is dissolved in the ice. Measurements of the CO2 content of ice samples from temperate and cold glacier ice as well as of freshly fallen snow and of a laboratory-grown single crystal were presented. It is probable that a local equilibrium is reached between the CO2 dissolved in the ice and the CO2 of the surroundings and of the air bubbles. The CO2 content of ancient air is directly preserved neither in the total CO2 concentration nor in the CO2 concentration in the bubbles. Possibly the CO2 content of ancient air may at least be estimated if the solubility and the diffusion constant of CO2 in ice are known as a function of temperature. (See also W79-09342) (Humphreys-ISWS)
W79-09364

THE RADIO-FREQUENCY BIREFRINGENCE OF POLAR ICE,
Scott Polar Research Inst., Cambridge (England).
N. D. Hargreaves.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 301-313, 1978. 4 fig, 1 tab, 32 ref, 1 append.

Descriptors: *Ice, *Electrical properties, *Optical properties, *Crystallography, Radio waves, On-site investigations, Polar regions, Anisotropy, Theoretical analysis, Mathematical models, Analytical techniques, Analysis, Electric fields, On-site tests, Monocrystals, Dielectric constants, Birefringence, Ice fabrics.

Radio-echo observations have shown that polar ice in situ is birefringent. The most likely explanation of the birefringence is an anisotropy in the radio-frequency dielectric constant of the ice single crystal, combined with the ordering of the orientations of the ice crystals in polar ice. It is possible to calculate the birefringence of ice which has a distribution of crystal orientations using a technique similar to that used to derive the dielectric properties of heterogeneous media. The experimentally observed birefringence may then be shown to be consistent with the crystal orientation fabric at the site of the observations if the anisotropy of the dielectric constant is slightly less than 1%, that is, slightly less than the accuracy of the laboratory measurements which have failed to detect any anisotropy. Further experimental observations might be used to obtain information on not only the level of anisotropy of the single crystal but also on the crystal orientation fabric of the ice. (See also W79-09342) (Humphreys-ISWS)
W79-09365

DIELECTRIC PERMITTIVITY OF GLACIER ICE MEASURED IN SITU BY RADAR WIDE-ANGLE REFLECTION,
Wisconsin Univ.-Madison. Geophysical and Polar Research Center.
K. C. Jezek, J. W. Clough, C. R. Bentley, and S. Shabtaie.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 315-329, 1978. 11 fig, 2 tab, 28 ref. NSF DPP72-05802.

Descriptors: *Ice, *Electrical properties, *On-site investigations, *Antarctic, Electric fields, On-site tests, Sounding, Frequency, Reflectivity, Radio waves, Radar, Remote sensing, Analytical techniques, Analysis, Velocity, Glaciers, Permittivity, Radio-echo sounding, Dielectric constants.

Values of relative permittivity measured by the wide-angle reflection technique on the Ross Ice Shelf show substantial variations between sites, from 3.09 to 2.89, with estimated errors of + or - 0.03. The largest values, closest to those normally measured in the laboratory, are found nearest to the grounded ice sheet; values decrease generally in the direction of thinner ice that has been longer on the ice shelf. It is believed that the variation reflects some real physical phenomenon in the ice shelf, either a true variation in the permittivity of the ice or a complication of the ray-path geometry, but it is not possible to offer a satisfactory model at present. (See also W79-09342) (Humphreys-ISWS)
W79-09366

THE ACTIVATION ENERGIES OF TEMPERATE SNOW SAMPLES,
Saint Andrews Univ. (Scotland). School of Physical Sciences.
L. T. Traub, and P. W. F. Gribbon.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 331-339, 1978. 3 fig, 1 tab, 11 ref.

Descriptors: *Snow, *Ice, *Activation energy, *Electrical properties, Crystallography, Conductivity, Electrical conductance, Electric fields, Frequency, Laboratory tests, Analysis, Measurement, Temperature, Permittivity.

The temperature dependence of the high-frequency conductivity of snow was studied for 8 samples in the range -10 C to -80 C. The activation energies for granular snow varied from 0.60 eV at temperatures down to -25 C to 0.24 eV at temperatures below -25 C, and for dry snow from 0.42 eV to 0.18 eV in the same temperature ranges. Dry snow samples had higher conductivities and lower activation energies than granular icy samples throughout the complete temperature range. Volume and surface conduction processes were operative. At the higher temperatures above -25 C, volume conduction was attributed to Bjerrum defect migration, while at lower temperatures, Bjerrum conduction was replaced by ionic-defect conduction. Granular samples which had experienced melting and refreezing on the surface of the crystals had a structural change which decreased the ionic-defect density at the surface and lowered the sample conductivity. Above -25 C, the activation energies for granular icy snow were consistent with those for temperate glacier ice and for laboratory single and polycrystalline ice samples, but were not in agreement with those of either polar snow or ice. Below -25 C, the activation energies for granular snow were consistent with those for temperate glacier ice containing impurities and for polar snow and ice. Fresh, dry, temperate snow samples had lower activation energies than in situ polar snow. (See also W79-09342) (Humphreys-ISWS)
W79-09367

THE CORE STRUCTURE AND THE MOBILITY OF DISLOCATIONS IN ICE,
Birmingham Univ. (England). Dept. of Physics.
R. W. Whitworth.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 341-359, 1978. 8 fig, 41 ref.

Descriptors: *Ice, *Molecular structure, *Model studies, *Reviews, Crystallography, Structure, Movement, Velocity, Analytical techniques, Theoretical analysis, Ice Ih, Ice dislocations, Water molecules, Ice mobility.

The evidence concerning the velocity of glide of dislocations on the (0001) plane of ice Ih was reviewed and related to atomic processes occurring within or near the dislocation core. The velocity is directly proportional to stress at low stress, with a value of the order of 500 Burgers vectors per second at -18 C and a stress of 100,000 N/sq m. The usual idea of a dislocation core is that it is 'crystalline' in the sense that the linkages between molecules are as far as possible the same as those in the normal lattice. For such a model, the disorder of protons presents an obstacle to dislocation movement, and recent theories predict that dislocations should not be able to glide as fast as they are observed to do. Various ways of avoiding this difficulty within the context of a crystalline core were discussed, but none seems likely to be successful. An alternative model is that the core is 'non-crystalline', with a disordered arrangement of mobile molecules within it. The movement of such dislocations should not be seriously impeded by proton disorder. Dislocation mobility would then be limited, at least in part, by an elastic loss due to the stress-induced order of protons in the surrounding lattice. (See also W79-09342) (Humphreys-ISWS)
W79-09368

COOPERATIVE MOVEMENT OF H2O MOLECULES AND DYNAMIC BEHAVIOUR OF DISLOCATIONS IN ICE IH,
Institut National des Sciences Appliquees, Lyon (France). Groupe d'Etudes de Metallurgie Physique et de Physique des Materiaux.
J. Perez, C. Mai, and R. Vassoille.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 361-374, 1978. 5 fig, 24 ref.

Descriptors: *Ice, *Model studies, *Crystallography, *Dynamics, Mathematical models, Analytical techniques, Theoretical analysis, Analysis, Movement, Velocity, Structure, Shear stress, Temperature, Equations, Ice Ih, Ice dislocations, Water molecules.

A new model of dislocations glide in ice Ih was proposed. In developing this model, certain assumptions were made: (1) dislocations have a non-crystalline extended core, and (2) transitions occur through cooperative movements of H2O molecules in the core of dislocations. A relation between the velocity of linear defects and shear stress tau or temperature, T, was obtained. This relation showed that velocity varies linearly with tau at low values of tau and/or T but varies more rapidly at higher stresses; this non-linearity is more pronounced the higher the temperature. Such results are in agreement with experimental data. (See also W79-09342) (Humphreys-ISWS)
W79-09369

INELASTIC BEHAVIOUR OF ICE IH SINGLE CRYSTALS IN THE LOW-FREQUENCY RANGE DUE TO DISLOCATIONS,
Institut National des Sciences Appliques, Lyon (France). Groupe d'Etudes de Metallurgie Physique et de Physique des Materiaux.
R. Vassoille, C. Mai, and J. Perez.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 375-384, 1978. 8 fig, 1 tab, 18 ref.

Descriptors: *Ice, *Deformation, *Crystallography, *Model studies, Mechanical properties, Laboratory tests, Testing procedures, Movement, Friction, Methodology, Analysis, Analytical techniques, Temperature, Strain, Velocity, Plastic deformation, Shear stress, Dynamics, Ice Ih, Monocrystals, Ice dislocations, Torsion, Internal friction.

The inelastic behavior of ice Ih single crystals was investigated with an inverted torsional pendulum in the low-frequency range. Three features were distinguished: (1) a relaxation peak previously observed in the higher-frequency range; (2) an internal friction increasing with temperature in the high-temperature range (230-273 K); and (3) within this high-temperature range, internal friction becomes amplitude dependent, and this dependence becomes greater the greater the temperature. In this case, the internal friction was interpreted in terms of movements of dislocations. Hence, the experimental results were interpreted with a model of internal friction based on an empirical relation for the velocity of dislocations. This model of internal friction is in fair agreement with experimental data. It is possible then to get an estimate of dislocation density. Hence, it was shown that internal friction experiments can be useful in the study of the plastic behavior of ice single crystals. (See also W79-09342) (Humphreys-ISWS)
W79-09370

OBSERVATION OF BASAL DISLOCATIONS IN ICE BY ETCHING AND REPLICATING,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
N. K. Sinha.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 385-395, 1978. 11 fig, 20 ref.

Descriptors: *Ice, *Crystallography, *Sampling, *Boundaries(Surfaces), Marking techniques, Methodology, Testing procedures, Instrumentation, Analytical techniques, Measurement, Polycrystalline ice, Ice dislocations, Etching, Replicating.

A method was described for preparing the surface of ice and for forming etch pits on the prismatic surfaces with whisker replicas that correspond to basal dislocations. The technique removes the ambiguity sometimes associated with etch pits and dislocations, and it allows direct observation of dislocation glide, pile-up against barriers, and other features in deformed ice. The ability to replicate minute changes in the microstructure of ice opens up further possibilities for the application of the technique; for example, examination of grain-boundary sliding, dislocation multiplications, voids, and cracks in polycrystalline ice produced during creep. (See also W79-09342) (Humphreys-ISWS)
W79-09371

X-RAY TOPOGRAPHIC STUDIES OF DISLOCATIONS IN VAPOR-GROWN ICE CRYSTALS,
Nevada Univ. System, Reno. Desert Research Inst.
C. V. McKnight, and J. Hallett.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 397-407, 1978. 9 fig, 21 ref.

Descriptors: *Ice, *Crystal growth, *Crystallography, Crystals, Methodology, Laboratory tests, Analytical techniques, Instrumentation, Topography, Shape, Freezing, Temperature, Structure, X-ray analysis, Surfaces, Ice dislocations, Vapor grown ice.

Ice crystals grown from the vapor under controlled conditions were examined by x-ray topography. Plates grown in the region -1.5 C to -3 C and at -15 C near water saturation were often free of defects, as were plates grown at smaller supersaturations (1.5% at -3 C, 6% at -15 C). It was inferred from these observations that growth was occurring by two-dimensional nucleation on the prism plane. It was suggested that multilayer adsorption on the crystal surface was responsible for growth at the low values of supersaturation, compared with higher values predicted by the Burton-Cabrera-Frank theory. Ice crystals dependent on dislocations for growth could only occur at supersaturations lower than these values. The crystal habit was interpreted as being dependent on differential two-dimensional nucleation on prism or basal faces. Rib structure is often associated with dislocation loops; stacking faults were evident in some crystals. (See also W79-09342) (Humphreys-ISWS)
W79-09372

STUDIES OF CRYSTAL IMPERFECTIONS IN ICE WITH REFERENCE TO THE GROWTH PROCESS BY THE USE OF X-RAY DIFFRACTION TOPOGRAPHY AND DIVERGENT LAUE METHOD,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
Y. Mizuno.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 409-418, 1978. 9 fig, 14 ref.

Descriptors: *Ice, *Crystal growth, *X-ray diffraction, *Crystallography, Topography, Shape, Structure, Laboratory tests, Testing procedures, Methodology, Analytical techniques, Frost, Glaciers, Analysis, Ice dislocations, X-ray topographs, Crystal imperfections.

This paper presented studies on crystal imperfections, including basal and non-basal dislocations, small-angle grain boundaries, stacking faults, and dislocation networks in ice using both x-ray diffraction and Laue techniques; these studies examined the growth process or origin of the ice, i.e., ice from glaciers, ice grown from the melt, or ice formed by sublimation. Several hoar crystals were found to be perfect, dislocation-free crystals. This may be due to their very slow growth rate. Dislocations and Shockley-type stacking faults were observed in some crystals. Dislocation density of a hoar crystal is very large at the point at which it started to grow, but away from this region, the density becomes so small that no dislocation can be seen. The arrangement and structure of dislocations around vapor figures were also studied by means of x-ray diffraction topography. It was found that the dislocation density is high along x-ray diffraction topography. It was found that the dislocation density is high along the periphery of the vapor hexagon and that the great majority of dislocations within the hexagon are running from its center towards the vertices or sides of the hexagon. Long screw dislocations with Burgers vector c (0001) were observed in a tabular ice, which was formed artificially at a very slight degree of supercooling. The behavior of dislocations in ice subjected to a tensile stress was studied by the use of the divergent x-ray techniques which gives both enlarged Laue spots and a transmission pattern in the same photograph. Use of the divergent Laue method indicated that an ice crystal could attain a greater degree of perfection as a result of the movement of pre-existing dislocations caused by a small deformation at low stress. (See also W79-09342) (Humphreys-ISWS)
W79-09373

A DEFORMATION MECHANISM MAP OF ICE,
Hokkaido Univ., Sapporo (Japan). Dept. of Applied Physics.
H. Shoji, and A. Higashi.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 419-427, 1978. 1 fig, 1 tab, 22 ref, 1 append.

Descriptors: *Ice, *Deformation, *Model studies, *Crystallography, Mapping, Rates, Activation energy, Mathematical models, Strain, Shear stress, Analytical techniques, Temperature, Movement, Creep, Mechanical properties, Ice dislocations, Polycrystalline ice.

A deformation mechanism map for pure polycrystalline ice of 2 mm grain diameter was constructed. New sub-regions in the dislocation glide region were proposed: dislocation glide with crack formation, dislocation creep, and fracture at high stresses above about 1 MPa. The boundary between the dislocation creep and DGC regions was determined by the onset of cleavage cracks due to piled-up dislocations near grain boundaries. The fracture region is that area of the map where fracture occurs readily when the ice is subjected to a rapid deformation rate exceeding 0.001/s. Experimental results of the stress dependence of the compressive deformation rate of polycrystalline ice were compared with the map. The effect of changes in the creep activation energy near the melting point was discussed together with those of other factors. At higher stress above 10 MPa, a pressure-melting region should be incorporated in the map, but it was not included. The map proposed was constructed for uniaxial compressive stress without any superimposed hydrostatic pressure. (See also W79-09342) (Humphreys-ISWS)
W79-09374

THE CREEP ACTIVATION ENERGIES OF ICE,
Birmingham (England). Dept. of Physics.
D. R. Homer, and J. W. Glen.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 429-444, 1978. 6 fig, 4 tab, 43 ref.

Descriptors: *Ice, *Creep, *Activation energy, *Crystallography, Laboratory tests, Measurement, Movement, Strain, Rates, Crystal growth, Temperature, Data collections, Testing procedures, Methodology, Mechanical properties, Analytical techniques, Analysis, Monocrystals, Bicrystals, Polycrystals.

Monocrystals and bicrystals of ice were creep tested at temperatures between -4 and -30 C. The bicrystals had a single grain boundary running parallel to the tensile axis; this configuration inhibited grain-boundary slip between the two grains. The creep tests, which were carried out at constant stress alpha and temperature T, yielded data of strain epsilon for time elapsed since the start of the test. These data showed accelerating creep for both monocrystals and bicrystals at all strain levels. Strain-rates were derived at strains of 0.01, 0.05, and 0.10, and these rates were fitted to the expression where epsilon varies as (alpha to the n power)exp(-E/kT), where k is Boltzmann's constant and E is the creep activation energy. Derived values of n were 1.9 for monocrystals and 2.9 for bicrystals. The creep activation energy was found to be 78 kJ/mol for monocrystals and 75 kJ/mol for bicrystals. The processes of creep deformation in mono-, bi-, and polycrystals were discussed. (See also W79-09342) (Humphreys-ISWS)
W79-09375

DEFORMATION OF ICE SINGLE CRYSTALS CLOSE TO THE MELTING POINT,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
S. J. Jones, and J.-G. Brunet.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 445-455, 1978. 13 fig, 11 ref.

Descriptors: *Ice, *Deformation, *Crystals, *Laboratory tests, Strain, Stress, Temperature, Testing procedures, Mechanical properties, Compressibility, Activation energy, Crystallography, Rates, Data collections, Monocrystals.

Constant strain-rate compression tests on ice single crystals at temperatures between -20 C and -0.2 C were described. The power-law dependence of yield stress on strain-rate gives a value of n which varies from 1.95 + or - 0.04 at -0.2 C to 2.07 + or - 0.08 at -20 C. The activation energy of deformation varies with strain-rate, but a mean value of 70 + or - 2 kJ/mol was obtained, with no indication of any increase close to the melting point as has been found in polycrystalline ice. An apparent work-hardening effect, at strains greater than about 15%, was explained as being due to bending of the crystal changing the orientation of the basal planes. (See also W79-09342) (Humphreys-ISWS)
W79-09376

SHORT-TERM RHEOLOGY OF POLYCRYSTALLINE ICE,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
N. K. Sinha.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 457-473, 1978. 10 fig, 41 ref.

Descriptors: *Ice, *Rheology, *Model studies, *Theoretical analysis, Deformation, Mathematical models, Strain, Analytical techniques, Physical properties, Youngs modulus, Mechanical properties, Creep, Movement, Elastic deformation, Non-Newtonian flow, Rates, Crystallography, Polycrystalline ice.

Deformation characteristics of polycrystalline ice and their dependence on time, temperature, and stress were analyzed on the basis of a phenomenological relation which describes creep in terms of initial elastic, delayed elastic, and permanent strain. It was shown that the effective modulus of ice observed in the laboratory or in the field can be examined on the basis of this model. The model also provides a basis on which the observed flow law of ice can be examined conveniently. Some apparent inconsistencies in the results of earlier investigations of the mechanical property of ice appear to be reconciled by the model. (See also W79-09342) (Humphreys-ISWS)
W79-09377

THE EFFECT OF ANISOTROPY ON THE CREEP OF POLYCRYSTALLINE ICE,
Melbourne Univ., Parkville (Australia). Dept. of Meteorology.
R. C. Lile.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 475-483, 1978. 3 fig, 1 tab, 9 ref.

Descriptors: *Ice, *Anisotropy, *Model studies, *Deformation, Crystallography, Creep, Mathematical models, Isotropy, Crystals, Physical properties, Strain, Stress, Analytical techniques, Equations, Data collections, Polycrystalline ice.

Quantitative effects of crystallographic orientation fabrics were incorporated into the flow law for isotropic polycrystalline ice by the introduction of an enhancement factor applied to the isotropic fluidity. An aggregate was viewed to a first approximation as a collection of grains deforming independently by basal glide. The influence of preferred orientations on the mean intragranular rate of strain was treated in terms of a redistribution of the magnitude and orientation of resolved basal shear stress. A quantitative measure of this effect on the fluidity of the aggregate was provided through the development of a geometric tensor and a stress configuration parameter. Intergranular interference was then considered as a dissipative process modifying the fluidity of the aggregate. Empirical justification for the model at low octahedral shear stresses was provided by several laboratory creep tests on naturally anisotropic borehole specimens under both in situ and anomalous stress situations. Predicted enhancement factors ranged from approximately 0.2 to 2.8 and agreed well with measured values. The tests were carried out in uniaxial compression and simple shear. (See also W79-09342) (Humphreys-ISWS)
W79-09378

THE INFLUENCE OF ICE-CRYSTAL SIZE ON CREEP,
Wisconsin Univ.-River Falls. Dept. of Plant and Earth Sciences.
R. W. Baker.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 485-500, 1978. 4 fig, 2 tab, 50 ref. NSF GA-19310, GA-42728.

Descriptors: *Ice, *Creep, *Particle size, *Crystallography, Crystals, Deformation, Size, Laboratory tests, Analytical techniques, Analysis, Stress, Strain, Rates, Temperature, Compressive strength, Physical properties, Mechanical properties, Polycrystalline ice, Ice dislocations.

Uniaxial compression tests were conducted on polycrystalline-ice samples with random c-axis orientation, and steady-state creep rates were determined. Experiments were conducted on both inclusion-bearing and inclusion-free ice and were run at constant stress and constant temperature. During freezing, the presence of inclusions in low concentrations inhibits crystal growth; variations in the volume-fraction of inclusions thus result in variations in ice-crystal size. The creep rate of polycrystalline ice at high temperatures and moderate stresses is extremely sensitive to variations in ice-crystal size. Due to an apparent inversion between dislocation-controlled creep and diffusion-controlled creep, the optimum grain size for creep resistance is about 1 mm. Increasing or decreasing the average crystal size from this critical value results in an increase in secondary-creep rate. (See also W79-09342) (Humphreys-ISWS)
W79-09379

THE CREEP OF NACL-DOPED ICE MONOCRYSTALS,
Birmingham Univ. (England). Dept. of Mechanical Engineering.
N. W. Riley, G. Noll, and J. W. Glen.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 501-507, 1978. 2 fig, 1 tab, 18 ref.

Descriptors: *Ice, *Creep, *Crystallography, Mechanical properties, Sodium chloride, Laboratory tests, Crystals, Shear stress, Sea ice, Glaciers, Analysis, Analytical techniques, Monocrystals, Polycrystalline ice, Doped ice.

Monocrystals of ice grown from NaCl solutions (concentration 0.0005 to 0.01 mol/l) were tested in creep at -10 C by basal glide. The maximum resolved shear stress ranged from 0.6 to 2.5 bar. The resulting creep curves show a deceleration, that is, the creep rate decreases with time. At the highest concentration, the creep is essentially transient; the strain tends to a fixed value. This is unlike the behavior of similarly orientated monocrystals of pure ice or of ice grown from solutions of other dopants so far reported in the literature. The possible causes for this behavior were discussed, and the implementations for the mechanical properties of polycrystalline ice, in particular sea ice and glacier ice, were described. (See also W79-09342) (Humphreys-ISWS)
W79-09380

ON THE RELATIONSHIPS BETWEEN LOW-DENSITY AMORPHOUS SOLID WATER AND ICE IH,
Chicago Univ., IL. Dept. of Chemistry; and Chicago Univ., IL. James Frank Inst.
S. A. Rice, W. G. Madden, R. McGraw, M. G. Sceats, and M. S. Bergren.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 509-535, 1978. 21 fig, 2 tab, 37 ref.

Descriptors: *Ice, *Crystallography, *Molecular structure, *Water structure, Theoretical analysis, Laboratory tests, Physical properties, Chemical properties, Density, Mathematical models, Water, Spectrophotometry, Temperature, Hydrogen bonding, Bonding, Analytical techniques, Analysis, Ice Ih, Polycrystalline ice, Water molecules.

New experimental and theoretical studies of low-density amorphous solid water (H2O (as)) and of polycrystalline ice Ih were reported and integrated with other available data. A variety of evidence was put forward to support the conclusion that low-density H2O (as) is derived from ice Ih by slightly increasing the dispersion in the O-O separation and by introducing a distribution of O-O-O angles (width c. 8 deg). Theoretical analysis focussed attention on the consequences of strong intermolecular coupling of OH oscillators. The vibrational modes of both ice Ih and H2O (as) were found to be complex mixtures of molecular motions, so the identification of regions of the Raman or infrared spectra of these materials with particular isolated molecule modes is not useful. The theory developed gives a good, but not perfect, account of the OH stretching regions of the observed Raman and infrared spectra of ice Ih and, to a lesser degree, of low-density H2O (as). (See also W79-09342) (Humphreys-ISWS)
W79-09381

DYNAMICAL PROCESSES AT THE ICE-WATER INTERFACE DURING SOLIDIFICATION,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festokoerperphysik.
J. H. Bilgram, and H. Guttinger.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 537-545, 1978. 7 fig, 7 ref.

Descriptors: *Ice, *Freezing, *Crystal growth, *Boundary processes, Growth rates, Crystallography, Dynamics, Spectroscopy, Interfaces, Ice-water interfaces, Laboratory tests, Methodology, Refractivity, Analytical techniques, Mathematical models.

The dynamics of the freezing process was studied at the surface of a growing ice crystal by means of Rayleigh spectroscopy. Light is scattered quasi-elastically at the interface. The line width is proportional to the square of the scattering vector. For a scattering angle of 90 deg, one measures about 2 krad/s. The line width does not depend on the growth rate or thermal gradients at the interface. Light is scattered isotropically, which indicates that the correlation length is small compared with the wavelength of the scattered light. The intensity depends on the growth rate and shows a hysteresis in that dependence; at a minimum growth rate, the onset of fluctuations is observed. (See also W79-09342) (Humphreys-ISWS)
W79-09382

CHARGE SEPARATION BY COLLISION OF ICE PARTICLES ON METALS: ELECTRONIC SURFACE STATES,
Eidgenoessische Inst. fuer Schneeund Lawinenforschung, Davos (Switzerland).
O. Buser, and C. Jaccard.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 547-557, 1978. 6 fig, 3 tab, 17 ref.

Descriptors: *Ice, *Electrical properties, *Electrical studies, Laboratory tests, Electric fields, Surfaces, Metals, Mathematical models, Analysis, Analytical techniques, Collision parameters, Permittivity, Surface charge.

The charge separation of ice particles colliding with metals was investigated in a wind tunnel (air speed 10 m/s) at a temperature of -45 C for different metals as a function of an applied external electric field. The ice particles (10 micrometer radius) collided with the metal target at a rate of 100,000 per second. The charge separation produced by different metals can be explained by the contact potential difference between the metal and the ice introducing electronic surface states on the ice. A lower limit for their density (10 to the 16th power/sq m) was found. The influence of the electric field was explained by an interaction between Bjerrum defects and the electrons of the metal, the transfer probability depending on the charge in the surface states. (See also W79-09342) (Humphreys-ISWS)
W79-09383

OPTICAL ABSORPTION SPECTRA OF H2O ICE DOPED WITH YTTERBIUM CHLORIDE YBCL3,
Centre National de la Recherche Scientifique, Orsay (France). Lab. Aime Cotton.
L. Couture.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 559-563, 1978. 2 fig, 1 tab, 8 ref.

Descriptors: *Ice, *Optical properties, *Absorption, *Crystallography, Chlorides, Spectroscopy, Analytical techniques, Ions, Laboratory tests, Analysis, Crystals, Doped ice, Rare-earth ions, Ytterbium chloride.

Near-infrared absorption spectra of a frozen dilute solution of ytterbium chloride were obtained at 77 K, 20 K, and 4.2 K. They contain two broad lines revealing a Stark splitting of 60/cm of the excited 2F sub 5/2 level of the Yb(3+) ion. Such spectra indicate that in frozen solutions of ytterbium chloride the Yb(3+) ions have crystalline or quasi-crystalline surroundings which are similar for most ions; possibilities were discussed. (See also W79-09342) (Humphreys-ISWS)
W79-09384

MOLECULAR ORBITAL CALCULATIONS OF WATER-ICE SURFACE INTERACTIONS,
Missouri Univ.-Rolla. Dept. of Physics.
P. L. M. Plummer.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 565-580, 1978. 13 fig, 2 tab, 27 ref.

Descriptors: *Ice, *Model studies, *Ice-water interfaces, *Boundary processes, Molecular structure, Crystals, Surfaces, Nucleation, Water, Hydrogen bonding, Analysis, Frequency, Energy, Interfaces, Ice Ih, Electron density.

Detailed knowledge of the energetics of the interaction of a water monomer with an ice surface is important in understanding the factors which control both the nucleation of an ice surface and semi-empirical quantum-mechanical calculations of the CNDO/INDO type to investigate the energentics of a gas-phase molecule approaching the surface. In the attempt to simplify the system as much as possible while retaining the essential features of the 'real' physical situation, 13 water molecules arranged in the lattice positions for ice Ih were used to represent the surface. Electron-density plots for both basal and prism surfaces were generated. Potential-energy curves were calculated for a monomer approaching a number of different sites on each type of surface. Monomer-surface binding energies varied from approximately 17 to 33 kJ/mol for the surface sites examined. Ion pairs of the H2O(+) - OH(-)-type were included in the surface, and their effect on the energy of interaction with an incoming monomer was calculated. For these studies, no distortion of the ice surface was allowed. The energies found follow the same trends as those observed for a free monomer-ion interaction. (See also W79-09342) (Humphreys-ISWS)
W79-09385

FRAZIL NUCLEATION MECHANISMS,
Wheeling Coll., WV. Dept. of Physics.
T. O'D. Hanley.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 581-587, 1978. 3 fig, 22 ref.

Descriptors: *Frazil ice, *Nucleation, *Ice, *Freezing, Crystallography, Theoretical analysis, Supercooling, Cooling, Analysis, Temperature.

It has been suggested previously that frazil nucleation occurs by a mechanism analogous to spinodal decomposition, aided by turbulence. After further study, the following points were made: (1) No critical point exists between solid and liquid; this rules out true spinodal decomposition. (2) Pure water can be supercooled to -40 C; at -40 C, the theoretical energy barrier to nucleation is about 10 to the minus 19th power J. Frazil forms after supercooling less than 0.1 deg; at this temperature, the theoretical energy barrier is about 10 to the minus 14th power J. (3) Theory shows that turbulence increases the energy barrier. (4) Turbulence may aid dissipation of heat solidification, but not sufficiently to account for observed frazil formation at small supercoolings. (5) The evidence that frazil can begin to form at supercoolings as small as 0.02 deg suggests that no nucleus except ice itself can account for 'heterogeneous' nucleation of frazil. (See also W79-09342) (Humphreys-ISWS)
W79-09386

STRUCTURE AND BEHAVIOUR OF GRAIN BOUNDARIES IN POLYCRYSTALLINE ICE,
Hokkaido Univ., Sapporo (Japan). Dept. of Applied Physics.
A. Higashi.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 589-605, 1978. 11 fig, 3 tab, 24 ref.

Descriptors: *Ice, *Reviews, *Crystallography, *Structure, Mechanical properties, Crystals, Mathematical modeling, Surfaces, Topography, Laboratory tests, Data collections, Analytical techniques, Bonding, Boundaries(Surfaces), X-ray diffraction, Movement, Oxygen, Polycrystalline ice, Ice dislocations.

Recent progress in studies of the structure and behavior of grain boundaries in ice was reviewed. As a lattice geometrical model of the boundary, the coincidence-site lattice (CSL) model was considered for ice crystals. Some evidence of the validity of this model was presented through observations of special shapes of natural snow, results of grain-boundary energy measurements, and direct microscopic observations of boundaries by X-ray diffraction topography. Although methods of measurement of grain-boundary energy have been developed recently, results are still not adequate to be analyzed in terms of real energetics for comparison with models of atomic bonding. Modern methods of observing grain boundaries in ice using X-ray diffraction topography were described. Observations of migrating boundaries have revealed that faceting along most closely packed CSL points impedes the migration of the CSL boundaries, while increased numbers of steps among facets with boundaries of other kinds enhance it. The mobility of a fast-moving boundary was determined to be of the order of 10 to the minus 10th power cu cm/dyn/s, either in the case when the driving force is the capillary force due to the boundary energy or when it is the stored energy of dislocations. (See also W79-09342) (Humphreys-ISWS)
W79-09387

CRYSTALLOGRAPHIC STRUCTURE OF POLYCRYSTALLINE ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
M. Matsuda, and G. Wakahama.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 607-620, 1978. 8 fig, 41 ref.

Descriptors: *Ice, *Structure, *Crystallography, *Bonding, Crystals, Oxygen, Hydrogen bonding, Molecular structure, Movement, Data collections, Glaciers, Analysis, Polycrystalline ice.

For several types of polycrystalline ice of different origins, the spatial lattice orientation of each crystal was determined by measurements of both the a- and c-axis orientations. Analyses of the orientations of adjoining crystals showed that a great majority of adjoining crystals may be in a twinning relation. With special reference to the multi-maximum c-axis preferred-orientation fabric (the so-called 'diamond pattern'), which is expected to occupy the largest part of a glacier ice mass, the crystal boundary structure was estimated. The preferred c-axis orientations of this fabric were explained as being the result of coincident oxygen-oxygen lines (hydrogen-bond lines) between adjoining crystals being concentrated in the orientations where 7 oxygen-oxygen lines of one single crystal of ice are distributed. From the above result, it was concluded that the multi-maximum fabric is of the polycrystalline structure closest to the structure of a single crystal of ice among all the fabrics found in large ice masses. It was found that the occurrence, in glaciers and ice sheets, of a multi-maximum fabric has a bias to the parts which have undergone a strong shear deformation for a long time. It is thus suggested that plastic deformation of ice with this fabric may be attributed to mechanical twinning due to a strong shear stress. (See also W79-09342) (Humphreys-ISWS)
W79-09388

ANELASTIC BEHAVIOUR OF POLYCRYSTALLINE ICE,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
P. Duval.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 621-628, 1978. 3 fig, 1 tab, 20 ref.

Descriptors: *Ice, *Creep, *Deformation, *Crystallography, Laboratory tests, Mechanical properties, Elastic deformation, Strain, Data collections, Analytical techniques, Stress, Glaciers, Time, Acti-

vation energy, Measurement, Velocity, Polycrystalline ice, Anelastic strain, Ice dislocations.

Torsion creep tests were performed on glacier ice at temperatures above -12 C. The polycrystalline ice, when unloaded, exhibits creep recovery. The time-dependent recoverable component of deformation (or anelastic strain) epsilon sub a was found to be adequately described by a relationship of the form: epsilon sub a equals delta tau log (1 + alpha t)/h where delta tau is the stress decrement, alpha a constant, and t the time. The anelastic modulus h defined for times t in excess of 3 h is always smaller than the dynamic elastic modulus. The movement of dislocations composing the subboundaries or in dislocation pile-ups may produce this important reversible deformation. The time-dependent recovery was explained in a similar way to the transient creep behavior observed at low temperatures for metals. The small temperature dependence of creep recovery would arise from the existence of a distribution of internal stresses values. (See also W79-09342) (Humphreys-ISWS)
W79-09389

X-RAY DIFFRACTION TOPOGRAPHIC OBSERVATIONS OF THE LARGE-ANGLE GRAIN BOUNDARY IN ICE UNDER DEFORMATION,
Hokkaido Univ., Sapporo (Japan). Dept. of Applied Physics.
T. Hondoh, and A. Higashi.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 629-638, 1978. 5 fig, 8 ref.

Descriptors: *Ice, *Deformation, *Crystallography, *Structure, Laboratory tests, X-ray diffraction, Analytical techniques, Crystals, Topography, Data collections, Testing procedures, Boundaries(Surfaces), Analysis, Photography, Surfaces, Polycrystalline ice.

Large-angle tilt grain boundaries in artificially-grown ice bicrystals were observed by the method of X-ray diffraction topography. In bicrystals for which misorientation angles satisfy the conditions of a high-density coincidence site lattice (CSL) at the boundary, the images of fine parallel line defects appear on the topograph taken immediately after a light deformation. Since these images disappear in a time period between several hours and a few days and reappear again at the same sites when the specimen is deformed subsequently, it was concluded that these line defects are not stable like the boundary dislocations but may be steps generated on the boundary to form facets which coincide with the high-density CSL plane. X-ray topographic images of boundaries which do not satisfy the conditions of a high density CSL are complex and difficult to interpret, although some of the images indicate that there may be different types of structures on such boundaries. (See also W79-09342) (Humphreys-ISWS)
W79-09390

REGELATION AND THE DEFORMATION OF WET SNOW,
Army Terrestrial Sciences Center, Hanover, NH.
S. C. Colbeck, and N. Parssinen.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 639-650, 1978. 8 fig, 1 tab, 17 ref.

Descriptors: *Snow, *Ice, *Deformation, *Crystallization, Crystallography, Model studies, Mathematical models, Boundary processes, Theoretical analysis, Density, Melting, Freezing, Crystal growth, Temperature, Heat flow, Growth rates, Boundaries(Surfaces), Films, Regelation, Wet snow, Phase equilibrium.

The thermodynamics of phase equilibrium control the temperature distribution around the ice particles in wet snow. When the snow is stressed, pressure melting occurs at the inter-particle contacts and the snow densifies. Densification was described by a physical model which simulates the heat flow, melt-water flow, and particle geometry. The effects of ionic impurities, liquid saturation, and particle size were demonstrated. Typical values of the temperature difference, inter-particle film size, and density were calculated as functions of time. The calculated rates of compaction are too large, hence, at some later time, the effects of simultaneous grain growth must be added to the model. (See also W79-09342) (Humphreys-ISWS)
W79-09391

FRACTURE TOUGHNESS OF ICE: A PRELIMINARY ACCOUNT OF SOME NEW EXPERIMENTS,
Cambridge Univ. (England). Cavendish Lab.
D. J. Goodman, and D. Tabor.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 651-660, 1978. 6 fig, 2 tab, 17 ref.

Descriptors: *Ice, *Laboratory tests, *Mechanical properties, *Failure(Mechanics), Analytical techniques, Testing procedures, Cracks, Sampling, Methodology, Analysis, Stress, Temperature, Strength of materials.

This paper described the first results from an experiment to measure the fracture toughness of ice. Two experimental techniques were used, first, fracture of pre-notched rectangular specimens in three- and four-point bending, and second, from the observation of the cracks which form underneath an indenter forced into the ice surface. In the second test the indenter behaves like a wedge. It was observed that for indenters with large interior angles, the plastic zone beneath the indenter may itself behave like a wedge. Data obtained over a range of temperatures were compared with the little other data available. A decrease of fracture toughness was found as the temperature was lowered. (See also W79-09342) (Humphreys-ISWS)
W79-09392

ANISOTROPY OF THE KINETIC FRICTION ON A SINGLE CRYSTAL OF ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
K. Tusima.
In: Symposium on the Physics and Chemistry of Ice; Proceedings of the Third International Symposium, Cambridge (England), September 12-16, 1977. Journal of Glaciology, Vol. 21, No. 85, p 661-668, 1978. 7 fig, 1 tab, 7 ref.

Descriptors: *Ice, *Anisotropy, *Physical properties, *Crystallography, Kinetics, Friction, Crystals, Measurement, Movement, Laboratory tests, Temperature, Analytical techniques, Analysis, Kinetic friction, Monocrystals.

Measurements were made of the kinetic friction which occurs when a tungsten carbide ball slides in various directions on the surface of a single crystal of ice, and the track width produced on the surface was also measured. Anisotropies were detected in both the friction coefficient and the track width. The track width phi was at a maximum when the ball was slid normal to the basal plane and at a minimum when it was moving parallel to (0001) in the temperature range -5 to -30 C. Although the friction coefficient was at a minimum when slid normal to (0001) and maximum in parallel to (0001) at temperatures of -19 C and below, this relation was found to be reversed at temperatures of -10 C and above. Anisotropy in track width can be explained in terms of the amount by which a slip system contributes to deformation in a specimen. However, our understanding of frictional anisotropy calls for knowledge of the ploughing strength p defined by the adhesion theory of friction. It was found that p reached a maximum in parallel to (0001) and a minimum normal to (0001). A remarkable frictional anisotropy was also observed on the surface inclined to the basal plane at 30 deg; the maximum friction coefficient was twice the minimum, whereas the maximum track width was only 1.3 times the minimum. (See also W79-09342) (Humphreys-ISWS)
W79-09393

2D. Evaporation and Transpiration

CALCULATED AND OBSERVED NONISOTHERMAL MULTIPHASE FLOW IN VERTICAL COLUMNS,
Atlantic Richfield Hanford Co., Richland, WA. Scientific Systems Dept.
R. W. Nelson, and P. G. Easley.
Available from the National Technical Information Service, Springfield, VA 22161 as ARH-SA-278, Price codes: A02 in paper copy, A01 in microfiche. Preliminary Report No. ARH-SA-278. (1976) Prepared for the U.S. Energy Research and Development Administration. 16 p. E (45-1) 2130.

Descriptors: *Mathematical models, *Water loss, *Soil moisture, *Deserts, Air, Sierozems, Nonisothermal multiphase flow, Vertical flow, Diffusion, Evaporation, Osmosis, Lysimeters, Moisture content.

The movement of air, water vapor, and liquid water in dry desert soils was modeled in a mathematical formulation. The model was applied to field measurements from two lysimeters at a site at the 200 Areas plateau of the Hanford Reservation in Washington. The water table is 60 to 90 meters below the ground surface with an average rainfall of 6.3 inches. The model allows for minor flow mechanisms important under long term arid conditions such as temperature induced flow, vapor diffusion, and osmotic effects. The model combines equations from the oil industry for non-isothermal multiple phase flow and those from soil science which include the effects of vapor diffusion in a static air phase. Finite differences or collocation on finite elements for long- one-dimensional vertical flow systems under very low moisture conditions can be used to solve the equation. Results show significant flow direction reversals caused by temperature induced vapor transport. Computations were qualitatively consistent with field observations at the lysimeter sites. (Seigler-IPA)
W79-09428

DEVELOPMENT AND EVALUATION OF EVAPOTRANSPIRATION MODELS FOR IRRIGATION SCHEDULING,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. L. Wright, and M. E. Jensen.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 88-91, 96, February 20, 1978. 6 fig, 1 tab, 7 ref.

Descriptors: *Evapotranspiration, *Model studies, Irrigation scheduling, Lysimeters, Soil water.

Evapotranspiration (ET) data for irrigated crops in southern Idaho were used to develop relationships for estimating net radiation and potential ET for the USDA-ARS Computerized Irrigation Scheduling Program. ET estimated with the initial relationships compared well with recent measurements obtained with two sensitive weighing lysimeters. The average daily measured ET for alfalfa for 128 days when there was full cover was 7.23 mm, while the average daily estimated ET was 7.15 mm. Crop curve relationships were developed from the ET results for snap beans (Phaseolus vulgaris L.). The depletion of soil water was predicted for two years of irrigated beans with the scheduling program using the improved crop curves and compared with the measured as a test of its performance. The standard deviation of the difference between predicted and measured was about 0.95 mm/day from planting until harvest. The results also demonstrated the importance of obtaining representative meteorological data for irrigation scheduling. (Skogerboe-Colorado State)
W79-09496

2E. Streamflow and Runoff

FLOOD PLAIN INFORMATION: RED LAKE RIVER, CROOKSTON, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for The City of Crookston, Minnesota, December 1974, 37 p, 26 fig, 18 plates, 4 tab.

Descriptors: *Minnesota, *Floods, *Indirect flood measurement, *Flood profiles, *Flood data, *Flood stages, *Peak discharge, *Flood plains, *Flood protection, *Crookston(MN), *Red Lake River(MN), Runoff, Flood flow, Flood forecasting, Historic floods, Flood frequency, Stage-discharge relations, Rivers, Floodways, Ice jams, Standard Project Flood, Warning systems, Control structures, Levee, Intermediate Regional Flood.

This report gives flood information for the Red Lake River in the vicinity of Crookston, Minnesota. The study reach is a tributary of the Red River and encompasses a drainage area of about 5,280 square miles above Crookston. This section of the river is about 18.3 miles long. Flood plain width varies from about 700-2,000 feet. The flood plain contains residential, commercial, and agricultural developments, and several parks and recreational facilities. A U.S. Geological Survey gage is located in Crookston. Causes of flooding include runoff from spring snowmelt, and occasional heavy summer rains. Obstructions to flood flow include trees, brush, and other floodway vegetation and floating ice blocks during spring thaw. Major floods occurred most recently in 1950, 1965, 1966, 1969, and 1974. The April 1969 flood had a peak discharge of 28,400 cubic feet per second (cfs), cresting at 27.3 feet above flood stage, while the April 1974 flood discharged 17,700 cfs and crested at 22.9 feet above flood stage. By comparison, the Intermediate Regional Flood (IRF) and the Standard Project Flood (SPF) are estimated to discharge 31,000 cfs and 51,400 cfs and crest at 26.9 feet and 30.1 feet, respectively. Flood damage reduction measures include construction of earth levees, flood warning and forecasting from the National Weather Service, and institution of a flood evacuation plan. (Arnold-NC)
W79-09338

SPECIAL FLOOD HAZARD INFORMATION: SOUTH BRANCH ROOT RIVER AT PRESTON, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for the City of Preston, Minnesota, June 1975, 45 p, 22 fig, 25 plates, 5 tab.

Descriptors: *Minnesota, *Floods, *Indirect flood measurement, *Flood profiles, *Flood data, *Flood stages, *Peak discharge, *Flood plain management, *Flood protection, *Preston(MN), *South Branch Root River(MN), Runoff, Flood flow, Flood forecasting, Flood frequency, Stage-discharge relations, Rivers, River beds, Floodways, Flood plains, Standard Project Flood, Flood plain zoning, Flood plain insurance, Planning, Control structures, Intermediate Regional Flood.

This report details flood hazard information for that portion of the South Branch of the Root River near Preston, Minnesota. A tributary of the Mississippi, the South Branch Root River encompasses a 180 square mile drainage area upstream of Preston. The study reach is 5 miles long with an average stream slope of 7.9 feet per mile. Development in the flood plain is primarily residential and recreational, with some industrial and commercial development. Data were obtained from one stream gage, newspaper files, historical documents and other records. The main flood season is during spring with some flooding occurring in summer. A flood improvement project in 1966 included construction of a bridge and channel widening. There are no existing structures for flood damage reduction in the study area. Obstructions to flood flow include trees, vegetation, dams, bridges, culverts and ice jams. The largest recorded flood occurred in March 1950, discharging 18,900 cubic feet per second (cfs) and cresting at 14.8 feet above flood stage. Another flood in 1965 discharged 7,000 cfs, cresting at 10.7 feet above flood stage. In comparison, the projected Intermediate Regional Flood (IRF) and the Standard Project Flood (SPF) would discharge up to 19,500 cfs and 51,300 cfs, respectively, below Camp Creek. Flood plain management program measures for the area are recommended to include flood control measures; strict adherence to the 1969 Minnesota Flood Plain Management Act; enactment of zoning ordinances, subdivision regulations, and building codes; memeberships in the National Flood Insurance Program; and floodproofing existing structures. (Arnold-NC)
W79-09339

FLOOD PLAIN INFORMATION: SNAKE RIVER, CITY OF WARREN, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for the City of Warren, Minnesota, September 1973, 34 p, 17 fig, 10 plates, 3 tab.

Descriptors: *Minnesota, *Floods, *Runoff, *Flood profiles, *Flood stages, *Peak discharge, *Flood peak, *Flood plains, *Channels, *Warren(MN), *Snake River(MN), Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Stage-discharge relations, Rivers, River beds, Standard Project Flood, Warning systems, Channel improvement, Intermediate Regional Flood.

This report gives flood information for the Snake River near Warren, Minnesota. The study reach a tributary of the Red River, is about 7 miles long with an average gradient of 3 feet per mile drop and encompasses a drainage area of 260 square miles. Flood plain width varies from about 500 to 2,500 feet. Seventy five percent of the City of Warren has been flooded by recent floods, and the entire town would be flooded by the Intermediate Regional Flood (IRF). Major causes of flooding are runoff from snowmelt and flow restrictions due to sewer backup. Obstructions to floodflow include trees, brush and vegetation in the floodway. Data were obtained from stream gages, newspaper files and historical records. Major floods occurred in 1896, 1901, 1950 and 1969. The April 1969 flood is the largest flood of record and had a peak discharge of 4,300 cubic feet per second (cfs), cresting at 19.4 feet above flood stage. The IRF and Standard Project Flood (SPF) would discharge 5,500 cfs and 10,500 cfs, respectively, cresting at 19.6 feet and 20.1 feet above flood stage. Flood damage reduction measures include clearing floodway of debris and tying in with the National Weather Service flood forecasting service. No city or county flood control or building code ordinances exist. This report is intended as a guide for land use planning and management decisions concerning flood plain utilization. (Arnold-NC)
W79-09340

FLOOD HAZARD INFORMATION: DOLORES RIVER AND TRIBUTARIES, DOLORES, MONTEZUMA COUNTY, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for Town of Dolores; Montezuma County; and the Montelores Planning Group, September 1978, 11 p, 31 plates, 2 tab.

Descriptors: *Colorado, *Floods, *Flood profiles, *Rivers, *Dolores River(CO), *Dolores(CO), *Montezuma County(CO), 100-year flood, 500-year flood, Regional flood, Indirect flood measurement, Storms, Cloudbursts, Historic floods, Flood data, Flood stages, Peak discharges, Flood plains, Flood protection, Flood plain insurance, Control structures, Reservoirs, West Dolores River(CO), Lost Canyon Creek(CO).

This report covers the findings of a flood hazard study of a 15-mile study reach of the Dolores River near Dolores, Colorado. A tributary of the Colorado River, the Dolores flows northwesterly into southeastern Utah to join that stream 100 miles northwest of the Town of Dolores. From its widest point, the Dolores River watershed encompasses a drainage area of about 570 square miles. The drainage basin is largely undeveloped, consisting of heavily forested areas within the flood plain. No significant future development is forecast. Other development in the floodway includes four highway bridges and a dam creating the McPhee Reservoir at the downstream limit of the study reach. A U.S. Geological Survey gage exists near the 4th Street Bridge at the Town of Dolores. Flooding from spring snowmelt runoff can occur, but flooding is primarily caused by summer cloudbursts. The largest flood of record occurred in October 1911, and other notable floods occurred in October 1941 and September 1970. The 100-year and 500-year floods would discharge 14,500 cubic feet per second (cfs) and 36,000 cfs, respectively, on the Dolores River below the mouth of Lost Canyon Creek. Velocity flow during a 100-year flood would reach 7-8 feet per second (fps), nearly the limit of 10 fps above which serious streambank erosion would occur. This report is intended to provide a basis for planning the best use of lands subject to inundation by the 100-year flood. (Arnold-NC)
W79-09341

FLOODS IN THE SKUNK RIVER BASIN, IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
A. J. Heinitz, and S. W. Wiitala.
Geological Survey open-file report 79-272, December 1978. 80 p, 28 fig, 2 tab, 9 ref.

Descriptors: *Flood profiles, *Floods, *Flood peak, *Flood discharge, *Historic floods, Flood frequency, Streamflow, Flow characteristics, Flood data, *Skunk River basin(Iowa).

Evaluation of flood hazards, and the planning, design, and operation of various facilities on flood plains require information on floods. This report provides information on flood stages and discharges, flood magnitude and frequency, and flood profiles for the Skunk River, Iowa, and some of its tributaries. It covers the Skunk - South Skunk Rivers to Ames, and the lower reaches of tributaries as follows: Squaw Creek, 8.2 miles; Indian Creek, 11.6 miles; North Skunk River, 83.2 miles; Cedar Creek, 55.8 miles; and Big Creek, 21.7 miles. The random nature of flood occurrence is illustrated by a graph of annual flood peaks at the gaging station on the Skunk River at Augusta. Maximum recorded flood discharges at gaging stations in the Skunk River basin are tabulated. A complete list of flood peaks for each station is included. (Woodard-USGS)
W79-09398

TECHNIQUE FOR ESTIMATING DEPTH OF 100-YEAR FLOOD IN NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
A. J. Velnich, and S. L. Laskowski.
Geological Survey open-file report 79-419, March 1979. 19 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Floods, *Flood plains, *Depth, *New Jersey, Streams, Flood profiles, Flood frequency, Flood forecasting, Methodology, Equations, Topography, Mapping, *Flood-prone areas, *Flood plain management, 100-year flood.

Techniques are developed for use in estimating 100-year flood depths on New Jersey streams. Equations and graphs are presented relating the 100-year flood depth above the mean annual flood to drainage area and area of lakes and swamps. Separate relations for the Coastal Plain and non-Coastal Plain streams in the four hydrologic areas in New Jersey are shown. A method of mapping flood-prone areas on U.S. Geological Survey 7.5-minute topographic quadrangles is detailed. (Woodard-USGS)
W79-09407

HEADWATER LOCATIONS OF U.S. STREAMS TRIBUTARY TO ST. LAWRENCE RIVER BASIN BETWEEN WESTERN OHIO AND EASTERN NEW YORK, EXCLUDING LAKE CHAMPLAIN BASIN,
Geological Survey, Albany, NY. Water Resources Div.
B. B. Eissler.
Geological Survey open-file report 79-255, 1979. 740 p, 1 fig, 3 plates, 3 tab, 4 ref.

Descriptors: *Headwaters, *Sites, *Streams, *Tributaries, *Great Lakes region, Lake Ontario, Lake Erie, St Lawrence River, Drainage area, Watersheds(Basins), Streamflow, New York, Ohio, Pennsylvania, Topographic mapping, *Quadrangles, *Niagara River.

The headwater locations of several thousand U.S. streams tributary to Lakes Ontario and Erie and the St. Lawrence and Niagara Rivers, from the

Maumee River in Ohio to the western border of the Lake Champlain basin in New York, including parts of Pennsylvania, are listed by quadrangle. The location of the headwater of each is given with reference to cultural and topographic features. 'Headwater' in this report is defined as the first site downstream from which the average streamflow is 5 cubic feet per second. The site locations were determined from drainage areas as indicated on topographic maps. The size of the drainage area required to produce an average flow of 5 cubic feet per second was determined from equations, developed separately for each State by regression techniques, that define the relation between streamflow and hydrologic factors of the region. Drainage area and precipitation were factors in the equations for all three States: forest cover was found to be significant in Ohio. (Woodard-USGS)
W79-09408

FLOWLINE STUDY, MISSISSIPPI AND ILLINOIS RIVERS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. E. Foster.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 695, Price codes: A04 in paper copy, A01 in microfiche. Mississippi Basin Model Report No. 31-5, June 1977. 62 p, 25 fig, 7 tab.

Descriptors: *Mississippi River, *Illinois River, *Flow characteristics, *Fixed-bed models, *Flood profiles, *Mathematical models, Flow profiles, Flow rates, Hydrographs, Levees, Inflow, Discharge(Water), Model studies.

The Mississippi Basin Model (MBM), a fixed-bed model of the Mississippi River and its tributary system from Hannibal, Missouri, to Baton Rouge, Louisiana, was used to develop water surface frequency profiles for portions of the Mississippi and Illinois Rivers. To insure the accuracy of the model, it was adjusted to reproduce the conditions of a 1973 flood. Model tests were conducted with three series of flows of 5 to 500 year frequencies and the agricultural and urban design floods on the rivers. Flowlines were tested with three levee conditions ranging from existing levees to proposed authorized levees. Water surface evaluations for all tests were recorded in the channel at all model gaging stations and at other points necessary to give a detailed profile at approximately one mile intervals along the various levee units. Major results show that existing federally constructed Mississippi River levees will protect against floods of at least a 50-year frequency. Also, increasing the height of existing levees to authorized grades would provide increased protection for these levee units but would raise stages slightly on unprotected areas. Levee maps and stage hydrographs are provided. (Seigler-IPA)
W79-09435

FLASH FLOOD DEFENSES,
National Oceanic and Atmospheric Administration, Boulder, CO. Atmospheric Physics and Chemistry Lab.
R. A. Maddox, and C. F. Chappell.
Water Spectrum, Vol. 11, No. 2, p 1-8, Spring 1979. 12 fig, 1 ref.

Descriptors: *Flash floods, *Flood forecasting, *Flood protection, Runoff, Meteorology, Thunderstorms, Hurricanes, Cloudbursts, Rainfall intensity, Rain gages, Clouds, Hydrography, National Weather Service, Flash Flood Alarm Systems, Johnstown(Pennsylvania), Satellite observation, Detection.

The severity of flash flooding in the United States and actions that can be taken to reduce the severity are discussed. During the 1970s, flash flooding became one of the most significant natural disaster problems in the United States. Flash flood fatalities exceed 160 annually, with property damage from all types of flooding exceeding one billion dollars annually. Reasons for these increases include: the rapid spread of urban development which often disrupts natural stream drainage patterns; vacationers often visit flash flood prone areas during periods of maximum threat; and people who live along 'controlled' streams and drainages often have the attitude that 'it can't happen here'. Two steps in an effective flash flood warning system, predictions and detection, are discussed. Ideally, the prediction phase should precede the actual flood by three to six hours so that state and local agencies can gear up to cope with the flood. The National Weather Service States Forecast Officers have the responsibility for monitoring meteorological conditions to determine if threatening conditions are developing. After a dangerous storm develops, the problem becomes one of determining if and where the heavy rains are falling. The simplest means of detection is through a cooperation spotter network. Several other detection devices are also discussed. (Seigler-IPA)
W79-09464

FLOOD HAZARD ANALYSES: BEAVER CREEK -- NAKED CREEK, ASHE COUNTY, NORTH CAROLINA,
Soil Conservation Service, Raleigh, NC.
In cooperation with the North Carolina Department of Natural Resources and Community Development, New River Soil and Water Conservation District, Board of County Commissioners, May 1979. 89 p, 40 fig, 14 tab, 9 ref, 8 append.

Descriptors: *North Carolina, *Beaver Creek, *Naked Creek, *Flood plains, *Flood plain insurance, Land use, Elevation, Mountains, Water levels, Urbanization, Aerial photography, Discharge(Water), Channels, Watersheds(Basins), Surface waters, Hydrographs.

A flood plain study was made for Ashe County, North Carolina to aid in developing regulations for flood plain land use and to qualify for flood insurance under the Department of Housing and Urban Development National Flood Insurance Program. Data are presented for Beaver Creek and Naked Creek, tributaries of South Fork of New River. The area is characterized by numerous high mountains and steep slopes, lower mountains with gentle slopes, and smooth rolling and gently rolling country between the mountains. Some development has already encroached onto the Beaver Creek flood plain. Additional pressure for flood plain development with future population growth and industrial expansion is anticipated. In the 10.4 mile length of Beaver Creek, Cole Brance, and tributaries 1 and 2, 247 acres are flooded with the 100-year flood and 284 acres with the 500-year flood. Some residential development has occurred on the Naked Creek flood plain. In the 6.4 mile length of Naked Creek, 204 acres are inundated with the 100-year flood and 241 acres with the 500-year flood. The potential for flooding along both creeks is high, with the annual flood event causing some flooding in the lower part of the flood plain. Data presented for identifying areas subject to flooding and the depth of flooding include: (1) flood hazard area photomaps; (2) flood profiles for the photomaps; (3) cross sections showing general valley and channel shapes; (4) discharge and elevation for selected floods; and (5) the description, elevation, and location for elevation reference marks. (Seigler-IPA)
W79-09477

FLOOD HAZARD ANALYSES: NORTH FORK -- NEW RIVER, ASHE COUNTY, NORTH CAROLINA,
Soil Conservation Service, Raleigh, NC.
In cooperation with the North Carolina Department of Natural Resources and Community Development, New River Soil and Water Conservation District, Board of County Commissioners, May 1979. 110 p, 93 fig, 4 tab, 10 ref, 8 append.

Descriptors: *North Carolina, *New River, *Flood plains, *Flood plain insurance, Land use, Elevation, Mountains, Water levels, Urbanization, Aerial photography, Discharge(Water), Channels, Watersheds(Basins), Surface waters, Hydrographs, Drainage area.

A flood plain study was made for Ashe County, North Carolina, to aid in developing regulations for flood plain land use and to qualify for flood insurance under the Department of Housing and Urban Development National Flood Insurance Program. The North Fork of New River has a drainage area of 289 square miles at its confluence with South Fork. In the 50.6 mile length of the North Fork, 1948 acres are inundated by the 100-year flood and 2,385 acres by the 500-year flood. The flood hazard analyses performed were developed for present conditions. Development in the area is primarily rural homes. Records show the August 14, 1940 flood to be the largest since 1908 when stream gage records were started. The potential for flooding along the North Fork is high, with the annual flood event causing some flooding in the lower areas of the flood plain. A well managed flood plain management program can limit the damage caused by these floods. Data presented for identifying areas subject to flooding and the depth of the flooding include: (1) flood hazard area photomaps; (2) flood profiles for the photomaps; (3) cross sections showing general valley and channel shapes; (4) discharge and elevation for selected floods; and (5) the description, elevation, and location for elevation reference marks. (Seigler-IPA)
W79-09478

FLOOD HAZARD ANALYSES: SOUTH FORK -- NEW RIVER, ASHE COUNTY, NORTH CAROLINA,
Soil Conservation Service, Raleigh, NC.
In cooperation with the North Carolina Department of Natural Resources and Community Development, New River Soil and Water Conservation District, Board of County Commissioners, June 1979. 158 p, 111 fig, 4 tab, 10 ref, 8 append.

Descriptors: *North Carolina, *New River, *Flood plains, *Flood plain insurance, Land use, Elevation, Mountains, Water levels, Urbanization, Aerial photography, Discharge(Water), Channels, Watersheds(Basins), Surface waters, Hydrographs, Drainage area.

A flood plain study was made for Ashe County, North Carolina, to aid in developing regulations for flood plain land use and to qualify for flood insurance under the Department of Housing and Urban Development National Flood Insurance Program. The area is in the Blue Ridge land resource area and is characterized by numerous high mountains, lower mountains, and smooth rolling country. The South Fork of New River has a drainage area of 324 square miles at its confluence with North Fork. In the 63.8 mile length of the South Fork, 3,423 acres flood with the 100-year flood and 3,969 acres with the 500-year flood. Development in the flood plain is primarily rural homes. The most recent flood occurred in 1978 and approached the 75-year flood. Flooding, caused by locally intense thunderstorms, and hurricanes, is often distributed throughout the year. The potential for flooding along the South Fork will remain high, with the annual flood event causing flooding in the lower areas of the flood plain. Data presented for identifying areas subjected to flooding and the depth of flooding include: (1) flood hazard area photomaps; (2) flood profiles for the photomaps; (3) cross sections showing general valley and channel shapes; (4) discharge and elevation for selected floods; and (5) the description, elevation, and location for elevation reference marks. (Seigler-IPA)
W79-09479

FLOOD HAZARD ANALYSES: STEWARTS CREEK--LOVILLS CREEK, SURRY COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
In cooperation with the North Carolina Department of Natural Resources and Community Development, Surry County Watershed Improvement Commission, June 1979. 154 p, 116 fig, 13 tab, 9 ref, 8 append.

Descriptors: *North Carolina, *Flood plains, *Land use, *Watersheds(Basin), Elevation, Mountains, Water levels, Urbanization, Aerial photography, Discharge(Water), Channels, Surface waters, Hydrographs, Drainage area, Flood control.

A flood plain study was conducted for Mount Airy and the surrounding area of Surry County to aid in developing a sound land use program. Stewarts Creek and Lovills Creek have their headwaters along the southern edge of the Blue Ridge Parkway in Carroll County, Virginia, and flow south to North Carolina and through Surry County to their confluence with the Ararat River. The area is a part of the South Atlantic Gulf Water Resources Region. The streams have cut rather narrow valleys ranging in depth from 50 to 300 feet below the level of the uplands. Stewarts Creek has a drainage area of 76 square miles and Lovills Creek has a drainage area of 36 square miles. Records show the June 14, 1947 flood to be the largest flood since 1904, when records were started. Development in the flood plain has occurred where the state road system crosses the flood plain. A well managed zoning ordinance can control this development so that flood damages will be minimal. Basic flood plain management measures are outlined. Data presented for identifying areas subject to flooding and the depth of flooding include: (1) flood hazard photomaps; (2) flood profiles for the maps; (3) cross sections showing general valley and channel shapes; (4) discharge and elevation for selected floods; and (5) the description, elevation, and location for elevation reference marks. (Seigler-IPA)
W79-09480

2F. Groundwater

APPROXIMATE WATER-LEVEL CHANGES IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS 1977-79, AND MEASURED COMPACTION 1973-79, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-09395

THERMAL GROUND-WATER DISCHARGE AND ASSOCIATED CONVECTIVE HEAT FLUX, BRUNEAU-GRAND VIEW AREA, SOUTHWEST IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 1A.
W79-09403

GEOPRESSURE IN THE CARRIZO-WILCOX AQUIFER SYSTEM OF TEXAS,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 1A.
W79-09409

USE OF HYDROGEOLOGIC MAPPING TECHNIQUES IN IDENTIFYING POTENTIAL GEOPRESSURED-GEOTHERMAL RESERVOIRS IN THE LOWER RIO GRANDE EMBAYMENT, TEXAS,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 1A.
W79-09410

WATER-TABLE MAP OF KENOSHA COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-09411

WATER-TABLE MAP OF MILWAUKEE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-09412

WATER-TABLE MAP OF RACINE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-09413

WATER-TABLE MAP OF WALWORTH COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-09414

WATER-TABLE MAP OF WAUKESHA COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-09415

HYDROGEOLOGY OF UNDERGROUND COAL MINES IN ILLINOIS,
Illinois State Geological Survey, Urbana.
K. Cartwright, and C. S. Hunt.
From: Proceedings of the International Symposium on Water in Mining and Underground Works, September 17-22, 1978, Granada, Spain. Reprint 1978 N, 21 p, 12 fig, 1 tab, 10 ref.

Descriptors: *Hydrogeology, *Illinois, *Coal mines, Groundwater, Pumpage, Conductivity, Piezometers, Hydraulic stress, Aquifers, Mine drainage, Tunneling, Subsidence, Rock properties, Salinity, Hydraulic gradients, Hydrostatic pressure, Stratigraphy.

Coal mines in the Illinois Basin Coal Field were studied to determine why they are generally 'dry' despite their locations in water-saturated rocks. There were exceptions, but most mines reported pumpage of less than 100 cubic meters per day. The hydrogeologic setting of the coal in this area is not affected by major tectonic deformations. Data from an abandoned well was obtained by observations during test borings, by examination of samples from cores, and by measurement of water levels in a series of piezometers set at different depths. An active well was also investigated using piezometers inserted in roof bolt holes in the roof of the mine. Three hydrogeologic settings in which water may be a problem in a mine are discussed. The most common setting is the situation where the mine approaches a buried distributary channel within the coal bearing rocks. Hydrogeologic results show that the low volumes of water from the studied mines are directly related to the extremely low hydraulic conductivity of the rock associated with the coal. (Seigler-IPA)
W79-09425

SULFIDE OXIDATION FRONT IN THE TUSCALOOSA AQUIFER AT THE SAVANNAH RIVER PLANT, SOUTH CAROLINA,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
I. W. Marine.
Available from the National Technical Information Service, Springfield, VA 22161 as DEMS-7672, Price codes: A02 in paper copy, A01 in microfiche. Presented at the 26th Annual Meeting of the Southeastern Section of the Geological Society of America at Winston-Salem, NC, March 25, 1977. 15 p, 3 fig, 2 tab. AT(07-2)-1.

Descriptors: *Savannah River Plant, *Dissolved oxygen, *Sulfates, South Carolina, Flow characteristics, Coastal plains, Saprolite, Clays, Aquifers, Hydrogeology, Groundwater movement, Limestone, Wells, Lithology, Acidic water, Water quality, Industrial water.

The inverse relationship of dissolved oxygen and dissolved sulfate in the waters of a coastal plain aquifer at the Savannah River Plant was investigated. The plant occupies approximately 300 square miles in south central South Carolina. It lies in the Atlantic Coastal Plain region (Aiken Plateau) and is dissected by tributaries of the Savannah River which forms its southwest border. The subsurface geology, hydrology, and lithology of the area are discussed. The Tuscaloosa aquifer is the primary industrial aquifer of the region. It ranges from 400 to 600 feet thick and produces over 1,000 gallons per minute from properly constructed wells. Water from the Tuscaloosa Formation is generally soft, acidic, and low in dissolved solids. Results show that where dissolved oxygen is about 8 parts per million (ppm), the sulfate content is less than 2 milligrams per liter (mg/l). Where dissolved oxygen is zero, the sulfate content is about 13 mg/l. The two areas of high and low oxygen content are distinctly separate and the boundary appears to be a sulfide oxidation front moving in the direction of groundwater flow. (Seigler-IPA)
W79-09426

2G. Water In Soils

MODIFICATIONS TO A SOIL OXYGEN DIFFUSION RATEMETER,
Maine Univ. at Orono. Northeast Plant, Soil, and Water Lab.
J. Bornstein, and M. McGuirk.
Soil Science, Vol. 126, No. 5, p 280-284, November, 1978. 1 fig, 5 ref.

Descriptors: *Aeration, *Soil gases, Oxygen, Laboratory equipment, Calibrations, Soil water.

Recent efforts to relate soil aeration to crop production rely in part on soil oxygen diffusion rate (ODR) measurements. The platinum microelectrode method is often used to measure the soil ODR. The electrode current is easily interpreted when the soil is saturated with water. When the soil is not saturated, the interpretation of the electrode current depends on the effective potential applied to the microelectrode. The effective potential cannot be measured directly, but is calculated from several other measured quantities. The equation for obtaining the effective potential is given for two types of ODR measurement systems. The second type is commercially available and offers several advantages, but has limited accuracy at low ODRs. Two modifications to the commercial system were described, both of which greatly increase the accuracy of the system. (Skogerboe-Colorado State)
W79-09503

2H. Lakes

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF ROSS LAKE, SNOHOMISH COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
N. P. Dion.
Geological Survey Water-Resources Investigations 78-44 (open-file report), 1979. 15 p, 3 fig, 1 tab, 10 ref.

Descriptors: *Lakes, *Limnology, *Chemical properties, *Biological properties, Physical properties, Aquatic productivity, Thermocline, Bathymetry, Lake morphology, Lake morphometry, Nutrients, Dissolved oxygen, Bacteria, Coliforms, Aquatic plants, *Ross Lake(Wash), Tulalip Indian Reservation, Snohomish County.

A study of the physical, chemical, and biological characteristics of Ross Lake in 1975 showed that the lake has no well-defined surface-water inflow and that thermal stratification is well established in summer. The water is of a calcium bicarbonate type, which is typical of lakes in western Washington. Biological productivity in the lake was low, as indicated by low to moderate chlorophyll a concentrations, by the general lack of submerged plants on the lake bottom, and by the moderate dissolved-oxygen depletion in the deeper zones during thermal stratification. The productivity probably was limited by the amount of phosphorus available. Increased productivity and the resulting growth of nuisance plants in the lake can be avoided by limiting phosphate inputs to their present or lesser rates. (Woodard-USGS)
W79-09402

EFFECTS OF IMPOUNDMENT ON WATER AND SEDIMENT IN THE ARKANSAS RIVER AT PUEBLO RESERVOIR.
University of Southern Colorado, Pueblo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 664, Price codes: A08 in paper copy, A01 in microfiche. Report No. REC-ERC-76-19, May 1977. Prepared for Bureau of Reclamation, Engineering and Research Center, Denver, Colorado. 164 p, 24 fig, 4 tab, 22 ref, 4 append.

Descriptors: *Water quality, *Limnology, *Trace elements, Arkansas River, Pueblo Reservoir, Pueblo Dam, Water analysis, Dams, Reservoirs, Suspended solids, Pre-impoundment, Post-impoundment, Multiple-purpose reservoirs, Sediment load, Chemical wastes, Water pollution effects.

Water quality of the Arkansas River and the Pueblo Reservoir was studied from 1972 to 1976. Prior to impoundment, the Arkansas River was monitored for concentrations of major and minor inorganic chemicals (Ag, Cu, Fe, Mn, Zn, Co, Pb, Cd, Hg, Li, Na, K, Ni, Mg, and Ca) within the dissolved fraction and suspended fraction of water. Other limnological parameters examined included: dissolved oxygen, conductivity, pH, turbidity, alkalinity, sulfate, temperature, hardness, chloride, total dissolved solids, and total suspended matter. Pre-impoundment and impoundment sediments were analyzed and compared for K, Na, Ca, Mg, Li, Cu, Cd, Pb, Fe, Mn, Zn, and Mo. The dissolved and suspended concentrations of all the parameters averaged much less than the recommended or maximum permissible limits. Nearly ideal growth conditions for salmonid fishes were indicated by dissolved oxygen and temperature data. For most parameters interesting seasonal, surface, and spatial trends were observed; the most frequent seasonal trend was the classic high winter values (low discharge) and low summer values (high discharge). Trends for Fe, Mn, and Zn did not follow classical outlines. Data indicates that reservoir sediments near the inlet are being enriched in a number of trace metals (Fe, Mn, Zn, and perhaps Mg, Cu, Cd, and Pb). (Schaefer-IPA)
W79-09440

LAKE ONTARIO REGULATION,
Corps of Engineers, Buffalo, NY. Buffalo District.
W. P. Erdle.
Water Spectrum, Vol. 11, No. 2, p 17-25. Spring 1979. 10 fig.

Descriptors: *Lake Ontario, *Regulated flow, *Water control, *Water resources development, St. Lawrence River, Riparian rights, Hydroelectric power, Dams discharge(Water), Water levels, Inflow, Reservoirs, Evaporation, Seasonal, Navigable rivers, Government interrelations, Flood control, Plan 1958-D.

The history of man's attempts to regulate Lake Ontario and the complexities of developing a plan which fairly distributes the benefits of regulation among riparian shipping, and power interests are discussed. Prior to the 1950s Lake Ontario was regulated only by nature. To a great extent the lake remains regulated primarily by nature since she still determines the inflows, but the construction of the St. Lawrence Seaway and Power Development Project in the 1950s did give man some control of the outflows from the system. Extensive dredging was performed to provide enlarged channels for the deeper draft ocean vessel that would use the system and to allow for higher outflows through the river. Control structures, dams, were built to generate electrical power and regulate the outflow from the lake. A regulation plan, 1958-D, to prescribe the outflow to be released from the dams under various conditions of lake levels and inflows, has been in effect since October 1963. Other plans have been considered and mathematically tested, but none to date have appeared as satisfactory as Plan 1958-D. The regulation of Lake Ontario has reduced the detrimental impact of sustained periods of both high and low precipitation over the Great Lakes Basin for nearly two decades. (Seigler-IPA)
W79-09466

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES, PART IV: GENERA HANTZSCHIA THROUGH PTEROMONAS COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
V. W. Lambou, F. A. Morris, M. K. Morris, W. D. Taylor, and L. R. Williams.
Ecological Research Series, Report No. EPA-600/3-79-024, March 1979. Prepared for the U.S. Environmental Protection Agency, Office of Research and Development 112 p, 2 tab, 4 ref, 1 append.

Descriptors: *Phytoplankton, *Eutrophication, *Lakes, *Water quality, Phosphorus compounds, Nitrogen compounds, Chlorophyll, Turbidity, Secchi disks, Alkalinity, Aquatic microbiology, Nutrients, Plant growth, Hydrogen ion concentration.

Data are presented for the environmental requirements and relative abundance of 47 phytoplankton genera. The data are based on the water quality relationships for about 180 genera and 700 species of phytoplankton determined from the National Eutrophication Survey in 1973. The survey involved 750,000 physical and chemical measurements made in 250 lakes, in 17 states. Of the 180 genera in the survey, 47 (alphabetically from Hantzschia through Pteromonas) are summarized here. The summaries are organized according to numerical dominance or non-dominance and occurrence or non-occurrence. The summaries are computer generated and include categories of: chlorophyll a, turbidity, Secchi disks, pH, dissolved oxygen, temperature, total phosphorus, nitrogen, and others. The summaries provide knowledge of the specific requirements or environmental limits for each taxon, and are useful for the development of biological tools for monitoring and predicting water quality or trophic condition. Results show a lake population bias toward the eutrophic end of the trophic spectrum. (Seigler-IPA)
W79-09469

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES, PART V: GENERA QUADRIGULA THROUGH ZYGNEMA COLLECTED FROM EASTERN AND SOUTHEASTERN LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
M. K. Morris, W. D. Taylor, L. R. Williams, S. C. Hern, and V. W. Lambou.
Ecological Research Series, Report No. EPA-600/3-79-025, March 1979. Prepared for the U.S. Environmental Protection Agency, Office of Research and Development. 106 p, 2 tab, 4 ref, 1 append.

Descriptors: *Phytoplankton, *Eutrophication, *Lakes, *Water quality, Phosphorus compounds, Nitrogen compound, Chlorophyll, Turbidity, Secchi disks, Alkalinity, Aquatic microbiology, Plant growth.

Computer generated summaries of the environmental requirements and relative abundancies of 45 phytoplankton genera are presented. The data are based on the water quality relationships for about 180 genera and 700 species of phytoplankton determined from the National Eutrophication Survey in 1973. The survey involved 750,000 physical and chemical measurements in 250 lakes, in 17 states. Of the 180 genera in the survey, 45 (alphabetically from Quadrigula through Zygnema) are summarized. The summaries are organized according to numerical dominance or non-dominance and occurrence or non-occurrence. Summary measurement categories include: chlorophyll a, turbidity, Secchi disks, pH, dissolved oxygen, temperature, total phosphorus, nitrogen, and others. The summaries provide knowledge of the specific requirements of environmental limits for each taxon, and are useful for the development of biological tools for monitoring and predicting water quality or trophic conditions. Results show a lake population bias toward the eutrophic end of the trophic spectrum. (Seigler-IPA)
W79-09470

PHYTOPLANKTON WATER QUALITY RELATIONSHIPS IN U.S. LAKES, PART VI: THE COMMON PHYTOPLANKTON GENERA FROM EASTERN AND SOUTHEASTERN LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
W. D. Taylor, S. C. Hern, L. R. Williams, V. W. Lambou, and M. K. Morris.
Ecological Research Series Report No. EPA 600/3-79-051, April 1979. Prepared for the U.S. Environmental Protection Agency, Office of Research and Development. 92 p, 5 fig, 5 tab, 29 ref, 2 append.

Descriptors: *Phytoplankton, *Water quality, *Lakes, *Eutrophication, *Aquatic microbiology, Biological indices, Algae, Chlorophyll, Seasonality, Light intensity, Turbidity, Secchi disks, Habitats, Phosphorus compounds, Nitrogen compounds.

Environmental conditions associated with the 57 most common genera of phytoplankton encountered in the National Eutrophication Survey of 250 lakes in 17 states during 1973 are analyzed and compared. The use of these phytoplankton as indicator organisms for monitoring water quality and/or the trophic condition of lakes is discussed. Most phytoplankton genera showed no distinct seasonality to their general occurrence, although some forms achieved numerical importance only during certain seasons. Flagellates and diatoms tended to dominate the spring plankton with blue-green and coccoid green most common in summer and fall. The physical and chemical lake data associated with the various occurrence categories (non-occurrence, non-dominance, and dominance) of common phytoplankton genera are summarized. These summaries can be used to develop biological tools for monitoring lake water quality or trophic state, and to suggest environmental control methods for problem algae. Study results show that the more common phytoplankton genera thrive over such a broad range of environmental conditions that no one genus is a dependable indicator of water quality or trophic conditions in lakes. However, the tendencies of some of the genera toward high or low ends of some parameters suggest a community-based trophic classification which 'sums the individual probabilities' of the genera to increase the resolution of trophic state estimates. (Seigler-IPA)
W79-09471

2I. Water In Plants

INFLUENCE OF PHOSPHORUS ON ZINC, IRON, MANGANESE, AND COPPER UPTAKE BY PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
A. Wallace, R. T. Mueller, and G. V. Alexander.
Soil Science, Vol. 126, No. 6, p 336-341, December, 1978. 3 tab, 28 ref.

Descriptors: Nutrient removal, *Nutrients, Zinc, Iron, Manganese, Copper, Phosphorus, *Plant growth, Beans.

Five cultivars of soybeans (Glycine max. L.) and a bush bean (Phaseolus vulgaris L. cv 'Improved Tendergreen') were grown in nutrient solutions with different P levels, solution pH, and, in the case of bush bean, at different Fe levels. The objective of the experiments was to obtain more definitive answers to problems of P-induced Zn and Fe deficiencies. Differential solution pH, obtained by adding solid phase $CaCO_3$ to the nutrient solution (about pH 7) vs. a regular solution (about pH 4-5), indicates that pH is very important in the effects obtained. At high pH, increasing solution P decreased the leaf, stem, and root concentrations of Zn, Mn, and Cu in soybeans. Iron was decreased in roots, but not in leaves and stems. In contrast, at low pH, increasing the P resulted in more Zn, Mn, and Cu but less Fe in leaves, stems, and roots. Results with bush beans were only slightly different from those with soybeans, and the Zn-P effects were modified slightly by Fe levels. High P decreased Fe transport to leaves in bush beans at low and high pH, but only at the high Fe level. (Skogerboe-Colorado State)

W79-09497

2K. Chemical Processes

OXIDATIVE RELEASE OF POTENTIALLY MINERALIZABLE SOIL NITROGEN BY ACID PERMANGANATE EXTRACTION,
Science and Education Administration, Beltsville, MD. Biological Waste Management and Soil Nitrogen Lab.
G. Stanford, and S. J. Smith.
Soil Science, Vol. 126, No. 4, p 210-218, October, 1978. 6 fig, 2 tab, 13 ref.

Descriptors: *Nitrogen, Soil tests, *Organic matter, *Soil chemistry, Laboratory tests, Oxidation.

The relation of potentially mineralizable soil nitrogen, NO, to the oxidative release of NH4-N from soil organic matter during extraction with acid KMnO4 was investigated, using 62 soils. Included in the study were members of 8 soil orders comprising 43 noncalcareous and 19 calcareous soils. Soils were extracted with 1 N H2SO4 solutions of 0.05 and 0.1N KMnO4 (HOx) and with 1 N H2SO4 (H) alone for 1 h at room temperature, and amounts of NH4-N released were determined. The expression HOx - H denotes the quantity of NH4-N released owing to partial oxidation of soil organic matter. Later, a more direct and simpler procedure for determining oxidative NH4-N release was adopted, in which soils were preextracted with 1 N acid, and the soil residues were extracted with acidic KMnO4. Regression equations that may be useful in predicting NO from the oxidative release of NH4-N were developed. Amounts of NH4-N released by oxidation with 1 N H2SO4 solutions of 0.05 and 1.0 N KMnO4, respectively, were approximately one-third and one-half of NO. It was concluded that the NH4-N was derived from oxidation of the soil organic N fraction most readily susceptible to biological mineralization. (Skogerboe-Colorado State)
W79-09491

EVALUATION OF AMMONIUM RELEASE BY ALKALINE PERMANGANATE EXTRACTION AS AN INDEX OF SOIL NITROGEN AVAILABILITY,
Science and Education Administration, Beltsville, MD. Biological Waste Management and Soil Nitrogen Lab.
G. Stanford.
Soil Science, Vol. 126, No. 4, p 244-253, October, 1978. 1 fig, 4 tab, 27 ref.

Descriptors: *Nitrogen, *Soil chemistry, *Organic matter, Laboratory tests, Hydrolysis, Oxidation.

The relation of potentially mineralizable soil nitrogen, NO, to hydrolytic and oxidative release of NH4-N from soil organic matter by extraction with alkaline permanganate was investigated using 62 soils representing several major agricultural regions in the United States. The NH4-N was recovered by steam-distilling 1-g samples of soil during extraction for 4 min with several concentrations of NaOH and KMnO4 in different combinations. The same concentrations of NaOH, without KMnO4, were used to determine amounts of NH4-N released by hydrolysis (B) during steam distillation. Oxidative release was estimated as the difference between total NH4-N produced during alkaline permanganate extraction (BOx) and that derived by NaOH distillation. With few exceptions, correlations of NO with BOx were as good as, or better than, simple correlations of NO with B or (BOx - B). Thus, the extra effort required for separate NaOH and NaOH-KMnO4 extractions did not appear to be justified. It was concluded that the alkaline permanganate methods thus far reported by various investigators, as well as modifications evaluated in this study, offer a less precise and reliable basis for predicting NO than does acid permanganate extraction for measuring oxidative release of NH4-N. (Skogerboe-Colorado State)
W79-09492

INFLUENCE OF PHOSPHORUS ON ZINC, IRON, MANGANESE, AND COPPER UPTAKE BY PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 2I.
W79-09497

EFFECT OF SULFATE IONS ON THE STABILITY AND EXCHANGE CHARACTERISTICS OF AN ALUMINUM-INTERLAYERED WYOMING BENTONITE,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
S. S. Singh, and N. M. Miles.
Soil Science, Vol. 126, No. 6, p 323-329, December, 1978. 2 fig, 4 tab, 16 ref.

Descriptors: *Bentonite, Suspension, Clay minerals, *Sulfates, Chemical precipitation, X-ray diffraction, Chemical properties, *Soil chemistry.

Aluminum-interlayered, Wyoming bentonite suspensions, containing different amounts of precipitated Al, were equilibrated with SO4 solutions at different concentrations. The amount of Al precipitated as Al-hydroxy complex was 400, 550, and 750 me/100 g clay, and the concentration of SO4 in solution was 10, 20, and 30 me/l. On equilibration, the hydroxy-Al interlayer precipitate in the Wyoming bentonite reacted with SO4 ions, and a neutral precipitate of aluminum hydroxy sulfate was formed. Heating the Wyoming bentonite to 700 C resulted in complete collapse, showing that the precipitate was no longer present in the interlayer space. A crystalline compound of aluminum hydroxy sulfate was formed as evidenced by x-ray diffraction patterns. In the case of Al-interlayered, Wyoming bentonite suspensions that were not equilibrated with SO4 solution, the Al-hydroxy precipitate remained in the interlayer space and blocked the exchange sites. Treatment of these samples with SO4 solutions resulted in an increase of exchange capacity that was concentration-dependent. (Skogerboe-Colorado State)
W79-09498

SPATIAL VARIABILITY OF SOLUBLE SALT CONTENT IN A MANCOS SHALE WATERSHED,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
R. J. Wagenet, and J. J. Jurinak.
Soil Science, Vol. 126, No. 6, p 342-349, December, 1978. 4 fig, 2 tab, 11 ref.

Descriptors: Salinity, Saline water, *Saline soils, Spatial distribution, Colorado River Basin, Sampling, Statistical methods, Soil chemistry.

A study was conducted to examine data collected in the microwatershed land process studies with regard to quantifying spatially variable soil properties. All 35 sampling sites were classified as occurring on the Mancos shale formation within a 777 sq km (300 sq mi) area of the Price River Basin. Samples were taken at 0-2.5, 2.5-7.5, and 7.5-15.0-cm depths. Using the electrical conductivity (EC) of either the 1:1 or saturation extract as the salinity index parameter, it was found that EC values were distributed log-normally about the mean EC value of 35 observations. The coefficient of determination for the log-normal statistical plots was 1.00 for all three depths sampled at the 35 sites. The variance in the EC values increased with depth. (Skogerboe-Colorado State)
W79-09499

2L. Estuaries

BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS,
Environmental Research Inst. of Michigan, Ann Arbor.
R. A. Shuchman, F. J. Thomson, and D. R. Lyzenga.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A027 468. Price codes: A02 in paper copy, A01 in microfiche. Quarterly Report 108900-7-L, July 1976. 23 p, 2 fig, 1 tab, 5 ref, 2 append. ONR N00014-74-C-0273.

Descriptors: *Beaches, *Coasts, *Remote sensing, *Model studies, Mathematical models, Planning, Reflectance, Analytical techniques.

During the quarterly period 1 April-15 July 1976, four activities took place. The second year interim report was extensively revised using comments from the sponsor and ERIM personnel and currently is in printing. A detailed program plan for 1974 ONR activities was written and distributed internally to key ERIM personnel for review. Work has commenced on obtaining critical optical properties of beach minerals needed as inputs into the Beach Environment model. In the water modeling area, work is progressing along two fronts: (1) a computer program has been written to implement a combined water-atmosphere model, and (2) further theoretical work has indicated a small correction to be made to the existing QSS model. (Sims-ISWS)
W79-09525

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALINATION PROCESS SYSTEM AND BY-PRODUCT RECOVERY,
Stone and Webster Engineering Corp., Boston, MA. (Assignee).
F. E. Conger.
U.S. Patent No. 4,141,825, 9 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1426, February 27, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, *Desalination apparatus, Reverse osmosis, Electrodialysis, Separation techniques, Brackish water, Saline water, Byproducts, Byproduct recovery.

The process system of the invention relies essentially on an electrodialysis installation in series (including recycle) with a reverse osmosis installation and with one or more brine concentrator methods and also with by-product recovery systems. The system processes pretreated brackish water in an electrodialysis subsystem to produce (1) product water and (2) moderately saline water of higher salt content than the entering brackish water. The moderately saline water is then processed in a reverse osmosis subsystem to product (3) product water, (4) brackish water and (5) brine. The brine is processed in brine concentration/by-product subsystems consisting of mechanical brine concentrators such as R.C.C. and solar ponds and molten salt units to produce distilled product water, by-products and discard. (Sinha-OEIS)
W79-09511

MEMBRANE SEPARATION OF WATER FROM AQUEOUS MIXTURES,
Monsanto Co., St. Louis, MO. (Assignee).
For primary bibliographic entry see Field 5G.
W79-09520

CELLULOSE ESTER ULTRA-FILTRATION MEMBRANES AND THEIR MANUFACTURE,
Canadian Patents and Development Ltd., Ottawa (Ontario). (Assignee).
O. Kutowy, W. L. Thayer, and S. Souriajan.
U.S. Patent No. 4,145,295, 9 p, 4 fig, 4 tab, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1019, March 20, 1979.

Descriptors: *Patents, *Membranes, *Semipermeable membranes, Filtration, Polymers, Desalination processes, Water pollution treatment, *Manufacturing processes, Ultrafiltration techniques.

This invention relates to cellulosic-ester semi-permeable membranes, and their preparation and more particularly to semi-permeable membranes for use

in ultra-filtration techniques such as in the desalination of sea water, and in the removal of salts, such as nickel chloride, from the effluent of plating processes and the like. The process for producing the membrane is described where a thin film is cast from a mixture comprising cellulosic ester polymer, pore forming additive and casting solvent. A portion of the casting solvent is removed from the film and the film is immersed in a geletion bath containing a polar organic compound which is miscible with the casting solvent. The improvement comprises controlling the temperature of the gelation bath at a selected temperature in the range -20 degrees C to + 30 degrees C and selecting the concentration of the polar compound in the gelation bath to be greater than that required to produce the initial minimum flux for the membrane. (Sinha-OEIS)
W79-09540

3B. Water Yield Improvement

GRAVITY-FED WATER SYSTEMS IN MINES,
Chambers of Mines, Johannesburg (South Africa). Environmental Engineering Lab.
A. Whillier, and J. Van Der Walt.
Journal of the South African Institute of Mining and Metallurgy, Vol. 77, No. 9, p 187-192, April 1977. 6 fig, 1 tab.

Descriptors: *South Africa, *Water shortage, *Dependable supply, *Water supply, *Piping system(Mechanical), *Hydrologic aspects, Water demand, Water sources, Pipes, Goose-neck inlets, Gages, Flow friction, Pipelines, Dams, Expansion, Shafts(Excavations), Gravity, Swirl.

Primary causes of water shortages in South African mines and some of the fundamental hydraulic principles that must be followed in gravity-fed water systems to alleviate the problems are discussed. Water shortages in mines as a result of underground dams running dry are significant due to losses in production because shortages have occurred during fire-fighting operations, and due to the increasing need of water for cooling. The major problem is that the construction of underground dams and pipes leading from the dams do not follow sound hydraulic practice. Six major principles of hydraulics are discussed in relation to water pipeline systems in mines. Topics covered include: pipe size, goose-neck inlets, flow capacity, swirl prevention, underground dam height, intermittent flow, and thermal expansion. Instructions are provided to aid in pin-pointing trouble in a system with simple pressure gauge measurements. Diagrams and calculations to illustrate the various hydraulic principles are included. (Siegler-IPA)
W79-09441

3C. Use Of Water Of Impaired Quality

SPATIAL VARIABILITY OF SOLUBLE SALT CONTENT IN A MANCOS SHALE WATERSHED,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
For primary bibliographic entry see Field 2K.
W79-09499

PROCESS FOR GAS CLEANING WITH RECLAIMED WATER AND APPARATUS FOR WATER RECLAMATION,
Texaco Inc., New York. (Assignee).
C. P. Marion, L. E. Estabrook, and G. N. Richter.
U.S. Patent No. 4,141,696, 13 p, 2 fig, 1 tab, 2 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1388, February 27, 1979.

Descriptors: *Patents, *Reclaimed water, *Impaired water use, Water treatment, Water reuse, Separation techniques, Flash distillation, Equipment.

Dispersions comprising water and particulate solids, i.e. carbon and ash, are produced in at least one gas cooling or scrubbing zone by quench cooling or scrubbing the raw gas stream from a partial oxidation gas generator with water. The dispersions are resolved by liquid extraction in a decanting zone to produce a water layer containing carbon, dissolved gas, and ash, and also a separate dispersion comprising carbon, extractant, and water. Solids-free water and liquid extractant are then separated for the dispersion in a distillation zone. This water is introduced on to a stripping plate of a flash column along with solids-free recycle condensate from the flash column. The solids-containing water from the decanting zone is flashed below the stripping plate and a portion is converted into steam. The steam passes up through holes or bubble caps in the stripping plate and is dispersed through the water contained on the plate. If desired, a portion of the water obtained from blowing-down a gas cooler may be flashed to steam below the stripping plate. Unvaporized water falls to the bottom of the column. A vertical weir separates the flash column at the bottom into two chambers. Solids settle out of the water in the first chamber and clarified water flows over the weir into the second chamber. Overflow water from the stripping plate is discharged below the water-level in the second chamber by way of a down-comer. Reclaimed water is pumped to the gas cooling and scrubbing zones from the second chamber, and waste water containing solids in the first chamber is discharged from the system. (Sinha - OEIS)
W79-09508

3F. Conservation In Agriculture

METHODOLOGIES FOR VALUATION OF AGRICULTURAL CROP YIELD CHANGES--A REVIEW,
Eureka Labs., Inc., Sacramento, CA.
For primary bibliographic entry see Field 6B.
W79-09489

POLLUTION CONTROL MANUAL FOR IRRIGATED AGRICULTURE,
Toups Corp., Loveland, CO.
K. Kepler, D. Carlson, and W. T. Pitts.
Publication No. EPA-908/3-78-002, August, 1978. 213 p, 30 fig, 28 tab, 131 ref, 4 append.

Descriptors: Water pollution control, *Agriculture, *Return flow, *Salinity, Sediment, *Nitrates, Pesticides, Salt balance.

The manual is intended to expand understanding of irrigated agriculture-water quality relationships to a broad group, including water quality interests, water resource interests, and agricultural field technicians. Collecting pertinent information on the irrigation system, sampling techniques, and evaluation techniques for determining the water quality impacts of return flows, combined with beneficial use aspects allow irrigation to be put into perspective with other elements of a water quality plan. Development of best management practices (BMP's) incorporates this water quality information plus information on the various agricultural practices. Understanding of local conditions affecting BMP's can be developed within the evaluation framework. Technical information on irrigated agricultural practices and the pollutants associated with return flows is presented in a manner which makes it available to the layman as well as to experienced personnel. Traditional and recently developed irrigation practices are developed and evaluated in terms of use, pollutant loading pathways, cost, and effectiveness. Pollutants are discussed in terms of occurrence in nature, loading mechanisms, evaluation techniques, and effect upon beneficial use. (Skogerboe-Colorado State)
W79-09490

AUTOMATION OF AN OPEN-DITCH IRRIGATION CONVEYANCE SYSTEM UTILIZING TILE OUTLETS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
L. J. Erie, and A. R. Dedrick.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 119-123, February 20, 1978. 6 fig, 6 ref.

Descriptors: *Irrigation ditches, Automation, *Automatic control, Tiles, Conveyance structures.

Nearly 80% of the irrigated lands in the United States use surface irrigation techniques. Most of the on-farm, irrigation-water distribution systems are of the open-ditch type. The latest trend in western Arizona and parts of California is to deadlevel fields, then irrigate from single or multiple outlets with large streams of water. These level basins are well adapted to automation. An automated irrigation system reduces farm labor requirements and, as an irrigation management tool, can reduce water application, improve crop production, and minimize scalding and thus stand loss. A 28.4-ha (70-acre) field irrigated with tile outlets was pneumatically automated using two types of pillows on the outlet side, in combination with automated jack-gates, from a centrally located concrete-lined canal. The present system is being used by the farmer, observed and amended by the researchers, and demonstrated to many U.S. and foreign visitors. (Skogerboe-Colorado State)
W79-09493

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
For primary bibliographic entry see Field 5B.
W79-09494

AUTOMATION OF ON-FARM IRRIGATION TURNOUTS UTILIZING JACK-GATES,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
A. R. Dedrick, and L. J. Erie.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 92-96, February 20, 1978. 6 fig, 3 tab, 7 ref.

Descriptors: *Surface irrigation, Automation, Automatic control, Turnouts.

The design, development, and installation of equipment used to automate existing single outlet turnouts (jack-gates) on a 26.3-ha (65-acre) field were described. Specific jack-gate modifications and equipment requirements; control center design associated with safety overflow, excess water after irrigation, and sequencing functions; and system operations were discussed. (Skogerboe-Colorado State)
W79-09495

DEVELOPMENT AND EVALUATION OF EVAPOTRANSPIRATION MODELS FOR IRRIGATION SCHEDULING,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2D.
W79-09496

SHOULD INTEGRATE PEAK LOAD WITH WATER MANAGEMENT,
Irrigation Age, Vol. 13, No. 1, p 64, September, 1978. 1 fig.

Descriptors: Irrigation practices, *Irrigation efficiency, Pumping, *Sprinkler irrigation, Water reuse, Center pivot systems, Water pressure, Farm equipment, Fertilizers.

Center pivot irrigators who rely on electricity could save up to $72 million a year if more 'integrated' peak electrical load and water management control systems were designed. And, the technical knowledge is available. At the same time, power suppliers would be able to more successfully deal with the problems of high peak electrical demands. The problem is that short term peaks require generation and transmission facilities that are underutilized during much of the year. Key to success with an integrated approach is that irrigation scheduling techniques, geared to saving both water and energy, would be used. Savings in nitrogen, pumping costs and system wear could amount to

another $60 million annually with better water management. (Skogerboe-Colorado State)
W79-09502

IRRIGATION SYSTEM AND IMPROVEMENT STRUCTURE THEREIN,
B. Courtright.
U.S. Patent No. 4,142,547, 8 p, 14 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 105, March 6, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation practices, Irrigation efficiency, Mechanical equipment, Automatic control, Prime mover, Torquing gear.

An agricultural irrigation system includes a prime mover or structural means to apply torque directly to an irrigation wheel line advancing it over a field. Means are provided the prime mover or associated structure so as to sense wheel line deflections, i.e., to sense whether or not the prime mover is leading or lagging a portion of the line. The translation means of the prime mover is driven independently of the torquing gear, and the ratio of the speeds of both is adjusted or varied automatically in response to the direction and degree of deflection of the wheel line relative to its nominal intended position. The adjustment occurs automatically so that the prime mover will automatically catch-up or slow-down to bring the line into its intended configuration, usually rectilinear. This is accomplished by reciprocating hydraulic jacks with associated structure to revolve the torquing gear of the wheel line and the capstan of the prime mover independently. Suitable valving means and appropriate linkage is made responsive to wheel line deflection for adjusting the pressure flow to such jacks, thereby automatically controlling and varying the speed of revolvement of the torquing gear and/or capstan as needed. (Sinha - OEIS)
W79-09518

CONTROL FOR ROTATING ARM IRRIGATION SYSTEM,
A. R. Orcutt.
U.S. Patent No. 4,142,548, 5 p, 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 105, March 6, 1979.

Descriptors: *Patents, *Irrigation systems, *Irrigation practices, *Irrigation efficiency, Control systems, Water pressure, Valves, Application equipment.

A control for a motor driven rotating arm crop irrigation system of the type having a low pressure control for stopping the water supply pump includes a normally closed discharge valve adjacent the supply connection to the arm. A control responsive to malfunction of the arm drive opens the discharge valve to release water and thereby decreases the pressure in the supply line; this lowers the pressure at the low pressure control of the supply which then operates to shut off the water supply. The power for the malfunction control including the discharge valve operation is supplied by a battery located adjacent the arm pivot and no electric power supply or control wires are required between the pivot area and the water supply equipment. (Sinha - OEIS)
W79-09519

EMITTER FOR DRIP IRRIGATION SYSTEMS,
E. M. Bright, Sr.
U.S. Patent No. 4,143,820, 10 p, 10 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 2, p 530, March 13, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, Flow, Water pressure, Application equipment, Cleaning, Drip irrigation, Flushing, Emitters.

A temperature insensitive, low cost, pressure regulating and remotely flusable emitter for drip irrigation systems comprises a nodal body insertable into the wall of a pipe and having an end face aperture in which a deflectable resilient element responds to interior water pressure changes. The resilient element is deflectable normally to the plane of the end face, and provides at least one edge surface in facing, shearing relation to the end face aperture wall. In a first mode, one or more slip apertures decrease in area in response to increases in interior water pressure within a nominal operating range. When the pressure is raised further, however, the resilient element is deflected across the end face aperture wall, to define at least one slip aperture providing a low volume by high velocity flow which creates a flushing or cleaning action. In a preferred form of structure, the end face of the nodal body is substantially parallel to the flow direction in the pipe and is thicker than the resilient strip, which has at least a double curvature that provides controlled deflection. Water flow along the pipe and the short path length through the aperture tend to prevent clogging, reducing the need for filtration equipment. (Sinha - OEIS)
W79-09524

METHOD AND COMPOSITION FOR IMPROVING THE FUNCTIONING OF DRIP IRRIGATION SYSTEMS,
Fertilizers and Chemicals Ltd., Haifa (Israel). (Assignee).
A. Gulko, and D. S. Greidinger.
U.S. Patent No. 4,145, 208, 5 p, 6 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 992, March 20, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Application methods, Irrigation efficiency, Fertilization, Nitrogen compounds, Ureas, Disinfection, Scaling, *Drip irrigation, Emitter clogging.

A method for improving the smooth functioning of drip irrigation utilizes some nitrogen-based compositions. The method consists in providing to the solution supplied to drip irrigation, a pH from about 0.05 to about 3.0, utilizing an aqueous solution of urea nitrate having a weight concentration from about 28 to 0.1 percent respectively. The urea nitrate may also be considered a valuable rich nitrogen fertilizer, being completely available to plants. Since by its dissolution in water it results in an acidic pH, it was found that it would be particularly suitable for drip irrigation fertilization giving rise to a controlled source of nitric acid. By it slow release of acidity, it will reopen or avoid any eventual clogging of the emitters by precipitates. Such precipitates are caused by dissolved minerals that come out of solution due to a change in pH or temperature, and from the crust formed inside the pipes and emitters which will first slow the flow and ultimately cause full clogging. Urea nitrate will also have a beneficial effect against common bacteria acting as a disinfectant agent. (Sinha - OEIS)
W79-09530

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD PLAIN INFORMATION: RED LAKE RIVER, CROOKSTON, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W79-09338

SPECIAL FLOOD HAZARD INFORMATION: SOUTH BRANCH ROOT RIVER AT PRESTON, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W79-09339

FLOOD PLAIN INFORMATION: SNAKE RIVER, CITY OF WARREN, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W79-09340

FLOOD HAZARD INFORMATION: DOLORES RIVER AND TRIBUTARIES, DOLORES, MONTEZUMA COUNTY, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W79-09341

ECONOMIC BENEFITS FROM INSTREAM FLOW IN A COLORADO MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W79-09416

WETLANDS AND FLOODPLAIN PROTECTION,
For primary bibliographic entry see Field 6E.
W79-09447

CUTTING FUTURE LOSSES: DROUGHT SPURS FEDERAL WATER POLICY REVIEW,
For primary bibliographic entry see Field 6E.
W79-09449

THE HYDRILLA MENACE,
B. Norton.
Water Spectrum, Vol. 11, No. 2, p 35-43, Spring 1979. 8 fig.

Descriptors: *Hydrilla, *Florida, *Aquatic weeds, *Aquatic weed control, Plant growth, Eutrophication, Harvesting, Navigable waters, Dredging, Tricthanolamine, Diquat, Copper compounds, Plant physiology, Reproduction, White Amur, Moths, Plant diseases, Fusarium.

Various treatment methods to stop the spread of the aquatic weed, hydrilla are discussed. Hydrilla is an exotic water weed similar to Elodea that was probably inadvertently introduced into a waterway in Florida near Miami in 1960. It now infests nearly 700,000 aquatic acres in the United States. It blankets Florida, extends north to Iowa, west to California, and is still expanding. Hydrilla is negatively heliotropic, it normally grows downward away from the sun and expands laterally. By the time it appears near the surface it has already been laying tubers in the substrate for up to three years. It can choke an entire waterway, hasten eutrophication, and cause the waterway to die. Mechanical harvesting as a treatment method requires intensive labor, is time consuming, and is not highly effective. Harvesting methods include pulling, raking, digging, draining, and dredging. Applications of chemicals are a common and relatively effective control method. They provide a long-lasting control, are less labor-intensive, and are generally easy to apply, however they do not eliminate the problem because of their ineffectiveness in attacking root systems. Biological controls, the introduction of an exotic species to attempt to control the hydrilla, may cause additional threats, but several possibilities are promising. No single method has been found to stop the hydrilla march and integration of methods provides only slightly better results. (Seigler-IPA)
W79-09468

MULTILEVEL APPROACH TO URBAN STORM WATER SYSTEMS PLANNING,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6A.
W79-09488

4B. Groundwater Management

PLAN OF STUDY FOR THE NORTHERN MIDWEST REGIONAL AQUIFER-SYSTEM ANALYSIS,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 6A.

W79-09401

SHOULD INTEGRATE PEAK LOAD WITH WATER MANAGEMENT,
For primary bibliographic entry see Field 3F.
W79-09502

4C. Effects On Water Of Man's Non-Water Activities

A PHANTOM DOCTRINE: THE ORIGINS AND EFFECTS OF JUST V. MARINETTE COUNTY (CONTROL OF LAKE SHORE EROSION THROUGH FILL PERMITS),
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 6E.
W79-09457

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NATIONAL PROGRESS IN CONTROL OF WASTEWATER FROM COAL CONVERSION PROCESSES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5C.
W79-09543

ORGANIC CONSTITUENTS OF WATERS ASSOCIATED WITH COAL AND OIL-SHALE CONVERSION.
Research Triangle Inst., Research Triangle Park, NC.
E. D. Pellizzari, and N. P. Castillo.
In: Proceedings of the Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies, September 25-28, 1978. Oak Ridge, Tennessee, CONF-780903. p 57-69, July 1979. 4 fig, 4 tab, 4 ref. 68-03-2368.

Descriptors: *Water pollution, *Oil shales, Energy conversion, Coals, Effluents, Fossil fuels, Organic compounds, Coal gasification, Coal conversion technology.

Aqueous samples from in situ and low-Btu coal gasification processes and from in situ oil-shale retorting experiments were analyzed for volatile and semivolatile constituents. A comparison of the organic composition in water from Hoe Creek, Hanna II (In situ methods) and low-Btu gasification processes showed a striking similarity in oxygenated organics with the principal difference being in their concentration. Furans and ethers were not detected in the in situ processes. Nitrogen-containing organics were absent in the low-Btu sample. Concentration of aromatics was higher in the Hanna II sample. In the semivolatile organics, phenols constituted the major percentage of all organics. A greater diversity of phenolic isomers as well as a series of carboxylic acids was detected in the Hoe Creek I sample. Organic composition of waters from in situ oil-shale processes are listed in a table. (See also W79-09541) (Chilton-ORNL)
W79-09544

TRACE ELEMENTS IN THE SOLVENT REFINED COAL PROCESSES, SRC I AND SRC II,
Washington State Univ., Pullman. Dept. of Chemistry.
R. H. Filby, and S. R. Khalil.
In: Proceedings of the Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies, September 25-28, 1978, Oak Ridge, Tennessee, CONF-780903. p 102-115, July 1979. 2 fig, 21 tab, 18 ref.

Descriptors: *Water pollution, Trace elements, Fossil fuels, Energy conversion, Waste water treatment, Water pollution treatment, Coals, Effluents, Mercury, Selenium, Arsenic, Coal conversion technology, Solvent refined coal process.

In SRC I and SRC II processes, water is produced as a reaction product and is also used as a quenching agent. These process waters contain trace metals from a number of sources in addition to hydrogen sulfide and soluble organic compounds. The treatment process in SRC I and SRC II involves flocculation with aluminum hydroxide, biodegradation of organic species, and filtration through activated charcoal. Although this treatment is designed primarily to remove organic species, it is also effective in reducing toxic trace element levels. The process water contains elevated levels of Hg, Se, and As and these levels are reduced to essentially background levels by the treatment process. (See also W79-09541) (Chilton-ORNL)
W79-09545

CHEMICAL SPECIATION OF HEAVY METALS IN POWER PLANT ASH POND LEACHATE,
Notre Dame Univ., IN. Dept. of Civil Engineering.
T. L. Theis, and R. O. Richter.
Environmental Science and Technology, Vol. 13, No. 2, p 219-224, February 1979. 7 fig, 4 tab, 15 ref.

Descriptors: *Water pollution, *Pollutant identification, Heavy metals, Powerplants, Fly ash, Chemistry, Chemical precipitation, Adsorption, Chemical speciation.

Measurements were made on samples from an active power plant fly ash disposal site and the data are organized via a thermodynamic approach which is facilitated by computer solutions to the equilibrium situation. Results of sample analysis showed that adsorption onto hydrous iron and manganese oxides is the major solubility control for cadmium, nickel, and zinc. In contrast, the solubilities of chromium, copper, and lead are controlled by discrete precipitates while adsorption is of diminished importance. The partitioning of metals between the soluble and particulate phases is strongly influenced by solution pH and to a lesser extent by complex forming ligands. (Chilton-ORNL)
W79-09573

5B. Sources Of Pollution

HYDROLOGIC CHARACTERISTICS OF THE LOS ALAMOS WELL FIELD, WITH REFERENCE TO THE OCCURRENCE OF ARSENIC IN WELL LA-6,
Los Alamos Scientific Lab., NM.
W. D. Purtymun.
Available from the National Technical Information Service, Springfield, VA 22161 as LA-7012-MS, Price codes: A04 in paper copy, A01 in microfiche. Report No. UC-11, Informal Report LA-7012-MS, November 1977. 63 p, 27 fig, 54 tab, 10 ref, 9 append. W-7405-Eng.36.

Descriptors: *Aresenic compounds, *Well data, *Hydrologic data, Water pollution, Pumping, Aquifer management, Water supply, Permeability, Water quality standards, Chlorides, Fluorides, Boosters, Lithologic logs, Logging(Recording), Sands, Sampling, Clays.

The results of arsenic concentration studies on well LA-6 are summarized and interpreted. LA-6 is one of six wells ranging in depth from 870 to 1965 ft that are completed in the Tesuque formation, the main aquifer of the Los Alamos area. Two unsuccessful attempts were made to reduce the aresenic concentration in LA-6 which began to increase in 1974 and early 1975. The first attempt was to determine which zone of the aquifer was yielding the high arsenic concentration. Water samples were collected at selected depths within the well, analyzed, and compared to geophysical logs. A high concentration of arsenic occurs throughout the aquifer adjacent to the well and the isolation attempt failed. Studies were also made of the possibility of reducing the arsenic concentration by using a combination of wells and restricting pumpage from LA-6. Test results were not satisfactory and LA-6 was placed on 'standby' to be used only in extreme emergency. The hydrologic characteristics of the wells in the Los Alamos well field are summarized and data from the well tests and related studies are provided. (Seigler-IPA)
W79-09429

THE CLEAN WATER ACT OF 1977: EXPANDED COMPETENCE OVER VESSEL-SOURCE POLLUTION,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 6E.
W79-09459

GREAT LAKES WATER QUALITY: SEVENTH ANNUAL REPORT, APPENDIX D: ANNUAL REPORT OF THE RADIOACTIVITY SUBCOMMITTEE,
International Joint Commission-United States and Canada, Windsor (Ontario). Radioactivity Subcommittee.
Submitted to the Implementation Committee, Great Lakes Water Quality Board, July 1979. 107 p, 6 fig, 38 tab, 48 ref, 1 annex.

Descriptors: *Lake Huron, *Lake Michigan, *Lake Erie, *Lake Ontario, *Lake Superior, *Water quality, *Radioactivity, Radioactive wastes, Water pollution, Reactors, Power generation, Nuclear fuel cycles, Waste storage, Core melt, Sludge, Effluents, Radionuclides.

Detailed information and data available as of May 1979 regarding radioactivity in the Great Lakes Basin are presented. The 13 nuclear generating stations in the basin with their 22 reactors have a total installed electrical generating capacity of 14,807 megawatts. The water quality objective for radioactivity is assessed, and significant changes for converting between dose and concentration are discussed. To describe the impact of nuclear fuel cycle activities on the basin, an overview of each step of the nuclear fuel cycle is presented with particular attention given to waste management, including the regulations and options for waste storage and disposal. The potential radiological impact on the Great Lakes Basin for each step, for both normal and abnormal operation, is considered to the extent possible. Radiological risk is also evaluated. Present fuel cycle activities, the specific impact of each, and their present waste management practices are described. Releases of radionuclides from nuclear facilities in the basin are tabulated for 1978. Amounts of radionuclides detected in the sludge and effluent of municipal sewerage plants are also reported. The overall radiological quality of the Great Lakes was essentially unchanged from 1977. Differences in the reported levels of radioactivity for the open lakes were not large and were not consistent enough to support long-term projections. (Seigler - IPA)
W79-09476

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, D. E. Smika, and D. F. Heermann.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR3, p 283-291, September, 1978. 6 fig, 2 tab, 8 ref.

Descriptors: Water pollution control, Nitrogen, Fertilizers, *Nitrates, Denitrification, *Groundwater, *Return flow, *Leachate, Sprinkler irrigation.

Excessive irrigation of the sandy soils to which center pivot sprinklers are adaptable can result in leaching of significant amounts of nitrogen fertilizer as NO3(-). Careful water management is an effective means of controlling NO3-N losses. The USDA irrigation scheduling program was used successfully to determine the timing and amount of irrigation necessary to maintain high crop yields yet minimize leaching losses. Although significant

NO3-N losses were measured from fields in the study area, neither the fraction of that NO3(-) present in return flows nor the mechanism of possible denitrification had been identified. It was expected that if, in fact, significant denitrification occurred in the vicinity of the water table as the data suggested, the potential for groundwater pollution by leached nitrates is considerably reduced. Even so, careful water management was considered to be an important factor in the irrigation program as it affects efficiency of fertilizer utilization, cost of energy for pumping, and ultimately the yield of crops produced. (Skogerboe-Colorado State)
W79-09494

A REVIEW OF THE ENVIRONMENTAL IMPACT OF GROUND DISPOSAL OF OIL SHALE WASTES,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5D.
W79-09572

5C. Effects Of Pollution

GREAT LAKES WATER QUALITY: SEVENTH ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION.
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Water Quality Board.
Submitted to the International Joint Commission, Canada and United States, July 1979. 117 p, 6 fig, 15 tab. Final Report under the 1972 Agreement.

Descriptors: *Lake Erie, *Lake Huron, *Lake Michigan, *Lake Ontario, *Lake Superior, *Water quality, Eutrophication, Water pollution, Phosphorus compounds, Gulls, Polychlorinated terphenyls, Nitrates, Nitrites, Mercury, Mirex, Waste water(Pollution), Regulation, Trace elements, Toxicity.

The progress made by the United States and Canada to comply with the goals of the 1972 Great Lakes Water Quality Agreement is reported. Highlights of the report are: (1) forty-eight problem areas were identified where water quality objectives or standards were exceeded, one more than in 1977; (2) decreases in the concentration of DDT, DDE, dieldrin, HCB, mirex, and PCB's in herring gull eggs from Lakes Superior, Huron, Erie, and Ontario were reported; (3) PCBs in Lake Michigan coho salmon and bloater chubs continued to decline; (4) a previously undetected type of compounds, polychlorinated terphenyls, was found in herring gull eggs from Lake Erie; (5) trace levels of dioxin were reported in fish from Lake Ontario; and (6) total phosphorus concentrations showed a decline in Lake Michigan and Ontario. Whole lake water quality assessments are presented with major emphasis on eutrophication, the control of phosphorus loadings, and persistent contaminants. Progress made with regulatory and remedial programs to reduce the input of pollutants to the Great Lakes System is reported. A glossary of commonly used terms and abbreviations in the field of water quality is included. (Seigler-IPA)
W79-09417

GREAT LAKES WATER QUALITY: SEVENTH ANNUAL REPORT, APPENDIX B: ANNUAL REPORT OF THE SURVEILLANCE SUBCOMMITTEE,
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Water Quality Board.
Submitted to the Implementation Committee, Great Lakes Water Quality Board, July 1979. 125 p, 30 fig, 35 tab, 26 ref.

Descriptors: *Lake Erie, *Lake Huron, *Lake Michigan, *Lake Ontario, *Lake Superior, *Water quality, Eutrophication, Water pollution, Phosphorus compounds, Gulls, Polychlorinated terphenyls, Nitrates, Nitrites, Mercury, Mirex, Hydrocarbon, Runoff.

A lake-by-lake water quality assessment of the Great Lakes with particular emphasis on contaminants is reported. Included is a final status report of Lake Michigan from the intensive studies of 1976-1977, and a preliminary analysis of the water quality of Lake Erie from the intensive studies of 1978. Whole lake assessments cover eutrophication, contaminants, and special problem areas for each of the five lakes. Although only limited surveillance work was performed on Lake Superior, results show a decline in most harmful contaminant concentrations. Lake Huron showed a decrease of total phosphorus at three water intakes along the eastern shore. Total phosphorus levels also continued to decrease in Lake Ontario, but nitrogen levels continued to increase. A review of the state of the art of measuring atmospheric inputs, including acid rain, contaminants, and nutrients is presented to serve as a basis on which atmospheric surveillance and monitoring strategy can be developed. Planned 1979 surveillance activities are outlined for eack lake along with the performing agency and cost. A bibliography of United States and Canadian surveillance and monitoring related studies is also provided. (Seigler-IPA)
W79-09418

GREAT LAKES WATER QUALITY: SIXTH ANNUAL REPORT, APPENDIX B: ANNUAL REPORT OF THE SURVEILLANCE SUBCOMMITTEE.
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Water Quality Board.
Submitted to the Implementation Committee, Great Lakes Water Quality Board, July 1978. 118 p, 25 fig, 33 tab, 14 ref, 3 append.

Descriptors: *Lake Erie, *Lake Huron, *Lake Michigan, *Lake Ontario, *Lake Superior, *Water quality, Eutrophication, Water pollution, Phosphorus compounds, Gulls, Polychlorinated terphenyls, Nitrates, Nitrites, St Lawrence River, Mercury, Mirex, Hydrocarbons, Runoff.

A lake-by-lake water quality assessment of the Great Lakes to provide a better understanding of the physical, chemical, and biological interactions that take place in these waters is reported. Eutrophication states, key contaminants, and special problem areas are identified for each of the five lakes. The lake assessments are designed such that the major issues of eutrophication and contamination are compared within and between lakes. Phosphorus loads are given for each lake with most of the lakes showing a decrease. Intensive analysis for persistent organic contaminants in herring gulls and their eggs revealed only one previously unreported class--polychlorinated terphenyls (PCTs). Findings from five studies conducted by the Data Quality Work Group are reported. A program description of planned 1979 Surveillance activities is included along with a bibliography of surveillance and monitoring studies. (Seigler-IPA)
W79-09419

GREAT LAKES SCIENCE ADVISORY BOARD, ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION, JULY 1979,
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Science Advisory Board.
July 1979. 117 p, 12 fig, 7 tab, 5 ref, 2 append.

Descriptors: *Great Lakes, *Water quality, *Environmental effects, *Eutrophication, *Toxicity, Water pollution, Sludge, Waste water treatment, Acidic water, Public health, Persistence, Phosphorus compounds, Detergents, Land use, Regional planning.

Four major areas are used to assess the Great Lakes Basin from an ecosystem approach. Acid precipitation is discussed to illustrate the broad implications of long-range transport of atmospheric pollutants. Topics reviewed that are pertinent to acid precipitation include: ecological effects, human health, import and export to and from the Basin, energy consumption, ameliorative and corrective measures, air pollution technology, regulatory options, and information needs. In the area of toxic substance control, a computer data base was developed to aid in forecasting those chemicals manufactured or used in the Basin with potential to persist and bioaccumulate with the ecosystem. Lists of hazardous and potentially hazardous polluting substances are provided in an appendix. Socio-economic futures for the Basin area are discussed in terms of future trends in: urban growth, land use (natural resources), local and regional planning, transportation, energy, investment and finance, and technological and social change. Environmental mapping is recommended as a tool which may aid future management efforts in the Great Lakes Basin. Eutrophication studies, the fourth major area, includes: phosphorus management strategies, health and ecological effects of detergent builders, sludge disposal research, bioavailability of phosphorus and the operation and maintenance of municipal waste water treatment plants. (Seigler-IPA)
W79-09463

GREAT LAKES WATER QUALITY: SEVENTH ANNUAL REPORT, APPENDIX G: ANNUAL REPORT OF THE COMMITTEE ON THE ASSESSMENT OF HUMAN HEALTH EFFECTS OF GREAT LAKES WATER QUALITY,
International Joint Commission-United States and Canada, Windsor (Ontario). Committee on the Assessment of Human Health Effects of Great Lakes Water Quality.
Presented to the Great Lakes Water Quality Board and to the Great Lakes Science Advisory Board, July 1979. 37 p, 2 fig, 1 tab, 57 ref.

Descriptors: *Great Lakes, *Water quality, *Water pollution, *Hazards, *Human pathology, *Toxicity, Public health, Lethal limit, Poisons, Environmental effects, Sludge, Wastes, Chemical interactions, Chemical degradation, Carcinogenicity, Mutagenicity.

A program to establish a running inventory of toxic chemicals used, manufactured, or imported into the Great Lakes Basin, and to evaluate their risk to human health and the environment is reviewed. Categories of criteria and a scoring system to classify the 400 chemicals identified in the Basin were developed. Categories are: acute toxicity, carcinogenicity, reproductive, heritable mutagenicity, neurobehavioral toxicity, and chronic adverse effects. Numerical scores are assigned under each category for the degree of hazard by oral, dermal, and aquatic dosages. Guidelines for determining estimates of human exposure to toxic compounds were also developed. Estimates of human exposure combined with data on toxicity provide a measurement of the public health concern for a given compound. The program also allows for the possibilities of chemical interactions, transformations, and degradation. (Seigler-IPA)
W79-09475

PROCEEDINGS OF THE SYMPOSIUM ON POTENTIAL HEALTH AND ENVIRONMENTAL EFFECTS OF SYNTHETIC FOSSIL FUEL TECHNOLOGIES, SEPTEMBER 25-28, 1978, OAK RIDGE, TENNESSEE.
CONF-780903. Oak Ridge National Laboratory, Oak Ridge, Tennessee, July 1979, 288 p.

Descriptors: *Environmental effects, *Energy production, *Fossil fuels, Public health, Conferences, Publications, Synthetic fossil fuel technology.

This was the first in a continuing series of Life Sciences Symposia of the Oak Ridge National Laboratory which consider broad topical areas of research and development of a multidisciplinary nature. Topics selected for the 1978 symposium were in response to national requirements of incorporating environmental- and health-protection goals in the implementation of energy programs. General subject areas included in the symposium were: technology and controls; chemical characterization in problem identification; biological effects studies; environmental transport and ecological effects; and occupational health control technology. Twenty nine papers were presented, and are included in the proceedings, which relate to current work and recent experimental findings related to the existing understanding of potential impacts and their reduction. (See W79-09542 thru W79-09547) (Chilton-ORNL)

W79-09541

POTENTIAL EMISSION, EFFLUENT, AND WASTE PROBLEMS IN COAL CONVERSION PROCESSES,
Pullman Kellogg, Houston, TX. Research and Development Center.
L. E. Bostwick.
In: Proceedings of the Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies, September 25-28, 1978. CONF-780903. p 5-13, July 1979, 2 fig, 26 ref.

Descriptors: *Environmental effects, *Pollution, Standards, Fossil fuels, Energy conversion, Coals, Effluents, Solid wastes, Coal conversion technology, Emissions.

This paper presents an overview of the problems and descriptions of the proposed solutions which were developed in an EPA-funded study on the application of control technology to liquid effluents, gaseous emissions and solid wastes from coal conversion processes. It was concluded that liquid effluents can be treated for recycling within the processes and thus avoid discharge to receiving waters, that gaseous and particulate emissions can be controlled to meet present environmental standards, and that it is possible to manage the disposal of solid wastes. (See also W79-09541) (Chilton-ORNL)
W79-09542

NATIONAL PROGRESS IN CONTROL OF WASTEWATER FROM COAL CONVERSION PROCESSES,
Oak Ridge National Lab., TN.
J. A. Klein.
Proceedings of the Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies, September 25-28, 1978, Oak Ridge, Tennessee, CONF-780903. p 15-21, July 1979. 4 fig, 3 tab, 12 ref. DOE W-7405-eng-26.

Descriptors: *Water pollution, *Environmental effects, Energy conversion, Fossil fuels, Coals, Oil shales, Effluents, Standards, Evaluation, Coal conversion technology.

An overview of national programs in the area of environmental control technology for coal conversion aqueous wastes is presented. Gasifiers now under development are capable of being operated under conditions in which they should produce little, if any, harmful pollutants but it is anticipated that most of the developing coal conversion processes will probably produce large quantities of effluents. The transfer of these effluents to streams will be of great concern since they will contain sizable amounts of known toxic and carcinogenic materials. A program to perform field evaluation studies is proposed. (See also W79-09541) (Chilton-ORNL)
W79-09543

EFFECTS OF COMPLEX EFFLUENTS FROM IN SITU FOSSIL FUEL PROCESSING ON AQUATIC BIOTA,
Wyoming Univ., Laramie. Dept. of Zoology and Physiology.
H. L. Bergman, G. M. DeGraeve, A. D. Anderson, and D. S. Farrier.
In: Proceedings of the Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies, September 25-28, 1978, Oak Ridge, Tennessee, CONF-780903. p 204-211, July 1979. 4 fig, 4 tab, 27 ref. ET-77-S-03-1761.

Descriptors: *Environmental effects, *Water pollution, *Fossil fuels, Effluents, Energy conversion, Rainbow trout, Daphnia, Mortality, Toxicity, Oil shales, Fathead minnows, Coal conversion technology, Coal gasification.

Acute and limited-chronic toxicity bioassays were conducted on process waters from Omega-9 retort water from the Rock Springs Site 9 in situ oil shale processing experiment and from Hanna-3 condenser water from the Hanna underground coal gasification experiment. Acute toxicity of tests of the retort water from Omega-9 oil shale experiment showed that the 96-h TL50 for rainbow trout and fathead minnows and the 48-h TL50 for Daphnia pulex were all at a retort water dilution of about 0.5%. In limited-chronic bioassays the threshold effect level for rainbow trout egg hatchability was at about 0.3% retort water and growth of rainbow trout fry was reduced at approximately 0.1% retort water. Acute toxicity bioassays with condenser water from Hanna-3 UCG experiment resulted in 96-h TL50 dilutions of about 0.1% for rainbow trout and fathead minnows and a 48-h TL50 of 0.2% for Daphnia pulex. Threshold level effects for fathead minnow egg hatchability and fry growth were about 0.04 and 0.02%, respectively. (See also W79-09541) (Chilton-ORNL)
W79-09546

RESPONSE OF AQUATIC BIOTA TO EFFLUENTS FROM THE FORT LEWIS, WASHINGTON, SOLVENT REFINED COAL PILOT PLANT,
Battelle Pacific Northwest Labs., Richland, WA.
J. B. States, C. D. Becker, M. J. Schneider, and J. A. Strand.
In: Proceedings of the Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies, September 25-28, 1978, Oak Ridge, Tennessee, CONF-780903. p 212-220, July 1979. 7 fig, 1 tab, 1 ref. DOE EY-76-C-06-1830.

Descriptors: *Environmental effects, *Water pollution, Aquatic life, Toxicity, Fossil fuels, Coals, Energy conversion, Effluents, Washington, Fort Lewis, Solvent Refined Coal, Coal conversion.

Samples of waste effluent from the Solvent Refined Coal pilot plant (SRC) were used to perform toxicity tests using mostly fish as test organisms. Results of the tests indicated that untreated liquid effluents originating within the plant contain features that make it highly toxic to aquatic life. Treated process effluent passing through the biodigester, sand filter, and activated charcoal filter is relatively low in toxicity to aquatic life. Screening of all potentially damaging source materials for acute and chronic effects at several levels of biological organization is suggested before turning to detailed chemical and biological investigations into exact causes of some of the more serious effects revealed by the present study. (See also W79-09541) (Chilton-ORNL)
W79-09547

ANALYSIS OF POPULATIONS OF BORING AND FOULING ORGANISMS IN THE VICINITY OF OYSTER CREEK NUCLEAR GENERATING STATION, ANNUAL PROGRESS REPORT, SEPTEMBER 1, 1977-AUGUST 31, 1978,
Lehigh Univ., Stone Harbor, NJ. Wetlands Inst.
K. E. Hoagland, and L. Crocket.
Report NUREG/CR-0634. March 1979. 114 p, 18 fig, 29 tab, 21 ref, 4 append. AT(49-24)-0347.

Descriptors: *Environmental effects, *Water pollution, Powerplants, Nuclear powerplants, Invertebrates, Aquatic life, Fouling, Oyster Creek, New Jersey, Discharge(Water), Fouling organisms, Borers, Shipworms.

The purpose of this investigation was to observe levels of shipworm infestation in areas adjacent to Oyster Creek Nuclear Generating Station, particularly in water intake and discharge systems. In addition, species composition, breeding, and settlement of all boring and fouling invertebrates that associate themselves with wooden test panels at 18 stations were observed. Data for the period May 1977-August 1978 is interpreted in context of results of observations made since 1971. In early spring of 1978, a shipworm outbreak occurred which was dominated by Teredo bartschi. A few T. navalis, B. gouldi, and T. furcifera were also found. The finding of one T. bartschi at Forked River Beach indicated that the species can be carried by recirculated waters. Dominant species of fouling organisms were found to change on a monthly basis but to repeat on a seasonal basis. Some competitive interaction between shipworms, Limnoria, and other organisms occupying wood substrates is indicated. (Chilton-ORNL)
W79-09548

RESPONSES OF SELECTED CHESAPEAKE BAY FISH AND INVERTEBRATE SPECIES TO NATURAL AND ARTIFICIAL THERMAL INCREASES - A REVIEW OF THE LITERATURE,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
L. H. Liden, and D. T. Burton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 596, Price codes: A03 in paper copy, A01 in microfiche. 1978. 58 p, 9 fig, 112 ref.

Descriptors: *Environmental effects, *Water pollution, *Thermal pollution, Nuclear powerplants, Temperature, Fish, Populations, Chesapeake Bay.

Data from biological literature were evaluated to ascertain what effects, if any, the thermal discharge from Calvert Cliffs Nuclear Power Plant would have upon populations of Pseudopleuronectes americanus, Morone saxatilis, Leiostomus xanthurus, Midropogon undulatus, Menidia menidia, Anchoa mitchelli, Brevoortia tyrannus and Crassotrea virginica and Callinectes sapidus living in Chesapeake Bay. It was concluded that the thermal discharge from the power plant had a maximum temperature increase of 5.6 C above ambient and that this would have little or no impact on the egg, larval, juvenile or adult populations of the studied species. (Chilton-ORNL)
W79-09549

ECOLOGICAL EFFECTS OF COAL-FIRED STEAM-ELECTRIC GENERATING STATIONS,
Environmental Research Lab.-Duluth, MN.
G. E. Glass.
In: Energy/Environment III. EPA Decision Series, Report EPA-600/9-78-022, October 1978. p 121-149, 19 fig, 7 tab, 34 ref.

Descriptors: *Environmental effects, *Powerplants, Electric power production, Fossil fuels, Mining, Transportation, Storage, Combustion.

The purpose of the program reported in this paper is to determine the ecological impact of increased fossil-fuel utilization. The program is in the third year of a 5-year plan. Projects were funded in the three major areas of mining, transportation and storage, and combustion of coal. This comprehensive report attempts to integrate and generalize the findings in these areas. (Chilton-ORNL)
W79-09550

WATER-RELATED ENVIRONMENTAL EFFECTS IN FUEL CONVERSION: VOLUME I. SUMMARY,
Water Purification Associates, Cambridge, MA.
H. Gold, and D. J. Goldstein.
Report EPA-600/7-78-197a. October 1978. 231 p, 52 fig, 69 tab, 74 ref. 68-03-2207.

Descriptors: *Environmental effects, *Water pollution, Cooling water, Water requirements, Fuels, Fossil fuels, Energy, Costs, Coal conversion technology.

In this examination of water-related effects to be expected from siting conversion plants in major coal and oil shale bearing regions of the U.S., 90 plant site combinations were studied (48 in Central and Eastern U.S. and 42 in Western). Several fuel technologies are examined. The results of this study include the range of water requirements, conditions for narrowing the range and bringing about optimum use of water, ranges of residual solid wastes, and cost and energy requirements for waste-water treatment. Emphasis is placed on the need for site and design specific studies. It is suggested that the amount of wet cooling be related to the cost of water in the specific area. All water requirements studied in this report are based on complete water re-use. (Chilton-ORNL)
W79-09551

FISH PROTECTION AT STEAM-ELECTRIC POWER PLANTS: ALTERNATIVE SCREENING DEVICES,
Oak Ridge National Lab., TN.
J. B. Cannon, G. F. Cada, K. K. Campbell, D. W. Lee, and A. T. Szluha.
Report ORNL/TM-6472, July 1979. 142 p, 67 fig, 19 tab, 135 ref. W-7405-eng-26.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Cooling water, Aquatic life, Mortality, Impingement, Alternative devices.

This study examines engineering feasibility, biological effectiveness and costs of alternative screening devices to be utilized for fish protection at power plant cooling-water intakes. Physical screening barriers which are considered include: conventional vertical traveling screens (VTS) with modifications, center-flow traveling screens, flush-mounted horizontal traveling screens (HTS), cylindrical wedge-wire screens, and radial well intakes. Behavioral screening devices considered are the angled HTS and louver and angled screen diversion systems. Radial well intakes and cylindrical wedge-wire screens function as exclusion devices. Exclusion devices conceptually provide the most effective means of minimizing impingement and entrainment mortality. The extent to which physical screening devices can reduce impingement and entrainment mortality is site and species specific. It was concluded that alternative devices are available to potentially reduce impingement and entrainment but that these are site specific. (Chilton-ORNL)
W79-09552

THE EFFECT OF TEMPERATURE ON THE TOXICITY OF CHLORINATED COOLING WATERS TO MARINE ANIMALS - A PRELIMINARY REVIEW,
Woods Hole Oceanographic Institution, MA.
J. M. Capuzzo.
Marine Pollution Bulletin, Vol. 10, No. 2, p 45-47, February 1979. 1 tab, 14 ref. ERDA E(11-1)-2532.

Descriptors: *Environmental effects, *Temperature, *Chlorine, Marine organisms, Toxicity, Absorption, Synergism.

This report is a preliminary review of the problem of temperature-chlorine toxicity based on data obtained from this study and from other published reports. Several marine organisms were exposed to toxicant added as free chlorine or chloramine for periods of 30 to 60 minutes. Except for the copepod, Acartia tonsa, temperature was found to have a synergistic effect on the toxicity of both halogen forms. It was suggested that this synergistic effect was due to an interaction of uptake rates and regulation of physiological rates. Greatest enhancement in sensitivity should be expected at the upper limit of a species' thermal tolerance. (Chilton-ORNL)
W79-09553

BIOACCUMULATION AND BIOAMPLIFICATION OF MERCURY COMPOUNDS IN A SECOND LEVEL CCNSUMER, GAMBUSIA AFFINIS - TEMPERATURE EFFECTS,
Bordeaux I Univ., Talence (Italy). Lab. d'Ecologie Animale.
A. Boudou, A. Delarche, F. Ribeyre, and R. Marty.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 6, p 813-818, 1979. 4 fig, 6 ref.

Descriptors: *Environmental effects, *Toxicity, Fish, Mercury, Absorption, Freshwater, Mortality, Food chains, Temperature, Direct contamination, Bioamplification.

Bioaccumulation was studied over a period of 30 days, starting with a quantity of 1 microg of methyl-mercury/l of water (1 ppb) at three temperatures (10, 18, and 26 C). The experimental trophic chain was Producer-Chlorella vulgaris, First level consumer-Daphnia magna, First level carnivorous-Gambusia affinis. Direct contamination studies were also carried out. Results indicated that methyl mercury is far more toxic than HgCl2 and that mortality increases as the water temperature rises. With a quantity of 1 ppb in the environment, the Gambusia affinis yields a concentration of toxicant mass of 27000 after 30 days contamination at 26 C. Studies of bioaccumulation by direct contamination (1 ppb in water) shows no proportional relation of the process to the time factor. A leveling off was pronounced at 18C. (Chilton-ORNL)
W79-09554

GROWTH RATES AND SIZE DISTRIBUTIONS OF FIRST-YEAR SMALLMOUTH BASS POPULATIONS: SOME CONCLUSIONS FROM EXPERIMENTS AND A MODEL,
Oak Ridge National Lab., TN.
D. L. DeAngelis, and C. C. Coutant.
Transactions of the American Fisheries Society, Vol. 108, No. 2, p 137-141, 1979. 3 fig, 23 ref.

Descriptors: *Model studies, Mathematical models, Fish, Bass, Growth rates, Temperature, Time, Size, Laboratory tests, Fry.

Techniques of mathematical modeling are applied to experiments on the growth rates of first-year smallmouth bass under laboratory conditions. Swim-up fry were studied for 2-3 weeks with groups being kept at constant temperatures ranging from 15.2 to 32.5C. Average length of fish in each group increased linearly with time (t) in a range from 10 to 30 mm. Variance about these mean lengths increased approximately as t square. The model shows that the observed length-vs-time phenoma are expected if the rates of increase of length of fish are independent of length and that rates for individuals are normally distributed about some mean rate of growth. Agreement between experiment and theory shown in this model suggests that there is some degree of determinism in the dynamics of size distribution. (Chilton-ORNL)
W79-09555

MEASUREMENTS OF THE EFFECT OF HEATING ON SURVIVAL AND GROWTH OF NATURAL PLANKTON POPULATIONS,
KEMA N.V., Arnhem (Netherlands).
M. Donze.
Verh. Internat. Verein. Limnol., Vol. 20, p 1822-1826, November 1978. 3 fig, 2 ref.

Descriptors: *Environmental effects, *Water pollution, *Thermal stress, Plankton, Populations, Temperature, Growth rate, Mortality.

Natural plankton populations were incubated in floating tanks, one of which was kept at elevated temperature. Phytoplankton species mostly retained a constant population independent of temperature shock and persistent temperature increase. Only a few species showed growth or decline of more than a factor of 2 in 10 days. Zooplankton populations generally increased and it was suggested that this might be due to the absence of predation, to the tanks being a more favorable environment than the river, or to the fact that they are given time to increase. Increased grazing did not take place. Increased temperature increased the growth rate of rotifers. Species of Brachionus died off after initial growth at higher temperatures due to infection. Copepod populations showed no damage after application of temperature shocks. Significant mortality was found in Cladocerans. After temperature shock of 13.5C, Bosmina and Daphnia showed initial decline with recovery in 5 days. (Chilton-ORNL)
W79-09556

STUDIES OF THE EFFECT OF COPPER, ZINC AND IRON ON THE BIOTIC COMPONENTS OF AQUATIC ECOSYSTEMS,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
M. Furmanska.
Polskie Archiwum Hydrobiologii, Vol. 26, No. 1/2, p 213-220, 1979. 2 tab, 7 ref.

Descriptors: *Environmental effects, *Water pollution, *Toxicity, Copper, Zinc, Iron, Aquatic life, Crustaceans, Fish, Snails, Plants.

Acute (48 hr) tests showed a decreasing order of toxicity for the metals used in these experiments to be copper, zinc, and iron. Crustaceans were the most sensitive animals with fish and snails being more resistant. In chronic tests (19 days) it was found that bottom sediment microorganisms which responded to traces of the investigated elements by a decrease in respiratory activity were most sensitive. Higher animals showing mortality at Cu, Zn, and Fe concentrations of 3.75, 6.25, and 7.5 mg/cubic dm, respectively, were less sensitive than bottom animals. Elodea canadensis was somewhat less sensitive, displaying leaf cellular structure deformation at concentrations of 51, 25, and 30 mg/cubic dm of Cu, Zn, and Fe, respectively. Psychrophilic bacteria were most resistant. Comparison of chronic and acute test showed that cumulative toxicity of copper, zinc and iron was nine times higher under conditions of the chronic test. (Chilton-ORNL)
W79-09557

CHLORINE IN THE MARINE ENVIRONMENT,
Woods Hole Oceanographic Institution, MA. Dept. of Biology.
J. C. Goldman.
Oceanus, Vol. 22, No. 2, p 36-43, 1979. 5 fig, 7 ref.

Descriptors: *Environmental effects, *Chlorination, *Water pollution, Marine environment, Water quality, Water chemistry, Public health.

This paper reviews the historical uses of chlorine in water purification, wastewater treatment and in anti-fouling of power plant cooling waters. The beneficial aspects of chlorination as well as recent widespread public concern over the presence of carcinogens in drinking water are discussed. The chemistry of chlorine in the marine environment and the hazardous effects upon marine biota are described. Hope is expressed for solutions to the many problems presented. (Chilton-ORNL)
W79-09558

MORTALITY OF YOUNG FISH IN THE COOLING WATER SYSTEM OF BERGUM POWER STATION,
KEMA N.V., Arnhem (Netherlands).
R. H. Hadderingh.
Verh. Internat. Verein. Limnol., Vol. 20, p 1827-1832, November 1978. 1 fig, 5 tab, 4 ref.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Fish, Mortality, Cooling water, Discharge(Water), Impingement.

These investigations showed that large numbers of organisms (up to 10 million/24 hours in May) are drawn into the cooling system of the Bergum power station. Smelt, pike-perch, and perch were the most abundant species. Entrainment mortality for smelt was 75% and impingement mortality was 95%. Percidae showed entrainment mortalities of 34% and impingement mortalities of 65%. It is suggested that mortality due to entrainment and impingement can be reduced by decreasing the amount of cooling water used. Investigations of diversion devices is planned. (Chilton-ORNL)
W79-09559

SOME PROBLEMS IN FINDING GOOD STANDARDS FOR COOLING WATER,
KEMA N.V., Arnhem (Netherlands).
F. B. J. Koops.
Verh. Internat. Verein. Limnol., Vol. 20, p 1833-1836, November 1978. 4 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Cooling water, Fish, Mortality, Discharge(Water).

Ways in which a certain quantity of waste heat can be discharged into surface water with the least possible effect on ecology is discussed. Increase in cooling water quantities to lower presently used discharge temperature showed negative rather than positive effects, especially on young fish. Decrease in cooling water quantity reduced damage to young fish without causing serious damage to

other organisms. Even at discharge temperatures in excess of 30C damage to young fish can be reduced by keeping the temperature jump of the cooling water as high as possible and consequently the quantity of cooling water as small as possible, taking due care that the maximum permissible discharge temperature is not exceeded. (Chilton-ORNL)
W79-09560

BEHAVIOURAL RESPONSES OF SOME MARINE BIVALVES TO HEIGHTENED SEAWATER COPPER CONCENTRATIONS,
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Zoology Unit.
A. R. Manley, and J. Davenport.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 6, p 739-744, 1979, 6 fig, 1 tab, 17 ref.

Descriptors: *Environmental effects, *Toxicity, *Water pollution, Copper, Mollusks, Animal behavior.

Specimens of Modiolus modiolus, Chlamys opercularis, Crassostrea giga, and Modiolus demissus were maintained at 12-15C. Specimens of the tropical Anadara-senilis were maintained at 25C. Animals were exposed to an increasing concentration of copper by introducing a constant flow of pollutant into their tanks. M. edulis, C. gigas, M. demissus, A. senilis and M. modiolus showed an initial shell valve adduction followed by testing behavior. Concentrations of total copper in seawater at which normal behavior was interrupted were: M. modiolus, 0.141 ppm; M. edulis, 0.021 ppm; C. gigas, 0.085 ppm; A. senilis, 0.120 ppm; and M. demissus, 0.05 ppm. The response of C. opercularis to increasing copper concentration was shown by an increase in the frequency of shell movement and it is suggested that this might represent an attempt at swimming but the animals were fixed in position. It was concluded that concentrations of total copper of the magnitude required to result in total valve closure are not normally encountered in the marine environment. (Chilton-ORNL)
W79-09561

OVERWINTER MORTALITY OF FINGERLING SMALLMOUTH BASS IN RELATION TO SIZE, RELATIVE ENERGY STORES, AND ENVIRONMENTAL TEMPERATURE,
Toronto Univ. (Ontario). Dept. of Zoology.
J. D. Oliver, G. F. Holeton, and K. E. Chua.
Transactions of the American Fisheries Society, Vol. 108, No. 2, p 130-136, 1979. 4 fig, 2 tab, 18 ref.

Descriptors: *Environmental effects, *Thermal stress, Bass, Winterkilling, Temperature, Size, Mortality.

Smallmouth bass of 0+ age and 55-107 mm total length were overwintered at temperatures simulating those of the natural environment. Final temperatures were 2, 4, and 6C. Final temperature did not influence mortality rates. Longer fish survived better than short ones. It was found that during wintering body ratios of dry weight/wet weight, lipid weight/dry weight, and ignitable weight/dry weight all decreased. It was suggested that there may be critical percentages of dry weight/wet weight and ignitable weight/dry weight below which fingerling smallmouth bass will die. (Chilton-ORNL)
W79-09562

INFLUENCE OF TEMPERATURE-SALINITY COMBINATIONS ON THE FOOD INTAKE, GROWTH AND CONVERSION EFFICIENCY OF GAMBUSIA AFFINIS (PISCES),
Bangalore Univ. (India). Dept. of Zoology.
K. Shakuntala, and R. Reddy.
Polskie Archiwum Hydrobiologii, Vol. 26, No. 1/2, p 173-181, 1979. 1 fig, 6 tab, 34 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Growth rates, Foods, Energy budget, Salinity, Food intake, Conversion efficiency.

Gambusia affinis were reared from day 1 to 50 days of age under temperature-salinity combinations of 20, 25, and 30 C and 0, 1, 3, 5, and 7% S. Higher temperature resulted in higher salinity preference where the fish showed maximum survival, daily food consumption and growth. At any one salinity level, maximum growth was shown at 25C. On the whole, maximum conversion efficiency was found at 20C (11.0 to 25.5%). (Chilton-ORNL)
W79-09563

HEAT AND COLD TOLERANCE OF THE PLANARIAN, DUGESIA JAPONICA, IN RELATION TO ACCLIMATION TEMPERATURE,
Osaka City Univ. (Japan). Dept. of Biology.
H. Tsukuda, K. Ogoshi, and T. Daikoku.
Annotationes Zoologicae Japonenses, Vol. 51, No. 2, p 70-78, 1978, 5 fig, 18 ref.

Descriptors: *Environmental effects, *Thermal stress, Resistance, Temperature, Aquatic life, Invertebrates, Planaria.

Planarians from stock culture were acclimated to 13, 18, and 23C for more than 6 months before temperature tolerance tests were conducted. Tolerance was tested on anterior and posterior as well as on whole intact animals. Tolerance of intact animals increased distinctly with acclimation temperature. All 23 C-acclimated animals survived 40 min exposure to 35C while 13C acclimated animals were subject to lethal effect in 20 min at 33C. Anterior and posterior halves were found to be more heat tolerant than intact animals and the difference between 13 and 18C acclimation was smaller. Histological examination showed that upon exposure to heat the epidermis is injured gradually from the head toward tail. (Chilton-ORNL)
W79-09564

TEMPERATURE EFFECT ON THE CONCENTRATION OF RADIONUCLIDES BY MARINE ORGANISMS,
National Inst. of Radiological Sciences, Nakaminato (Japan). Marine Radio-Ecological Research Station.
M. Nakahara, T. Koyanagi, and M. Saiki.
Journal of Radiation Research, Vol. 18, p 122-131, 1977, 4 fig, 3 tab, 16 ref.

Descriptors: *Environmental effects, *Thermal stress, *Radioisotopes, Marine organisms, Fish, Clams, Cobalt, Cesium, Zinc, Temperature, Sea water.

Several species of marine organisms were exposed to radionuclides at varying seawater temperatures. Exposure of mackerel (Scomber japonicus) to Zn 65 resulted in concentration factors increasing 1.5 to 2.5 times and release of Zn 65 being increased from 10 to 70% at temperatures of 12 to 22C. Concentration of Cs 137 by blackfish (Girella punctata) in the temperature range of 15 to 35C was most pronounced at 20 to 25C. Concentration of Co 60 by crimson sea breams (Erynnis japonica) was highest in scale and gill tissue. Accumulation of Co 60 in midgut tissue of clams (Meretrix lamarkii) was also affected by temperature. (Chilton-ORNL)
W79-09565

DIFFERENTIATION IN RESPONSE TO CHILLING TEMPERATURES AMONG POPULATIONS OF THREE MARINE SPERMATOPHYTES, THALASSIA, TESTUDINUM, SYRINGODIUM FILIFORME AND HALODULE WRIGHTTI,
Texas Univ. at Austin. Plant Ecology Research Lab.
C. McMillan.
American Journal of Botany, Vol. 66, No. 7, p 810-819, August 1979, 9 tab, 16 ref.

Descriptors: *Environmental effects, *Aquatic plants, Cold resistance, Temperature, Resistance, Populations, Gulf of Mexico, Caribbean, Genetics.

Three species of seagrasses from the Gulf of Mexico-Caribbean were subjected to chilling temperatures. Response of populations from the southern portions of the Gulf and Caribbean showed the greatest chill damage while those populations from the northern gulf showed least injury. Decreasing order of chill tolerance in three species was Halodule, Thalassia Syringodium. C14 uptake by leaves following chill exposure showed quantitative differences correlating with the amount of leaf damage in the various populations. Data suggested an inherently different percentage of fatty acid saturation in temperate and tropical populations. No significant change in saturation of fatty acid occurred upon chilling in Texas plants. It was concluded that differentiation of response to chilling among the seagrass populations is based on inherited properties. (Chilton-ORNL)
W79-09566

RESPIRATORY RESPONSES OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) TO ENVIRONMENTAL CHANGES IN TEMPERATURE AND DISSOLVED OXYGEN,
California Univ., Davis. Div. of Wildlife and Fisheries Biology.
J. J. Cech, Jr., C. G. Campagna, and S. J. Mitchell.
Transactions of the American Fisheries Society, Vol. 108, No. 2, p 166-171, 1979, 2 fig, 2 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Dissolved oxygen, Drought tolerance, Droughts, Bass, Mortality.

Respiratory metabolism of largemouth bass under conditions of high temperature and low dissolved oxygen such as characterize drought environments was measured. Critical oxygen tensions were found to increase from <40 torr P02 at 20C, to 40-50 torr at 25C, to 50-60 torr at 30C. Increased anaerobic metabolism associated with an oxidative metabolic depression was indicated at high temperatures and low dissolved oxygen concentrations. It was concluded that maintenance of 2.60 mg 02/1 at 25C and 2.85 mg 02/1 at 30C in largemouth bass habitats would reduce adult mortalities which are associated with insufficient oxygen. (Chilton-ORNL)
W79-09567

EFFECTS OF CADMIUM ON THE INTRACELLULAR POOL OF FREE AMINO ACIDS IN MYTILUS EDULIS,
Northeastern Univ., Boston, MA. Dept. of Biology.
L. B. R. Briggs.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 6, p 838-845, 1979, 1 fig, 4 tab, 16 ref.

Descriptors: *Environmental effects, *Water pollution, Metals, Cadmium, Mussels, Amino acids, Salinity, Toxicity.

Groups of mussels were kept at salinities of 30, 11, and 6% and exposed to additional cadmium concentrations of 0, 0.1, 1.0, and 5.0 ppm. After 208 hours exposure, cadmium had a significant effect upon alanine, glycine, and the total FAA osmolarity. There were no statistically significant cadmium-salinity interaction effects at this time. Mussels in 11 and 6% salinity did not open their valves for extended periods of time. These results indicate that saturation of the detoxification system in M. edulis occurs at about 1 ppm cadmium in 30% S water. (Chilton-ORNL)
W79-09568

THE EFFECT OF PHYSICAL FACTORS ON THE COLONIZATION AND RELOCATION BEHAVIOR OF IMMATURE BLACK FLIES (DIPTERA: SIMULIIDAE),
Michigan State Univ., East Lansing. Dept. of Entomology.
E. F. Gersabeck, Jr., and R. W. Merritt.
Environmental Entomology, Vol. 8, No. 1, p 34-39, February 1979, 2 fig, 2 tab, 30 ref.

Descriptors: *Environmental effects, *Animal behavior, Larvae, Diptera, Insect behavior, Flow, Temperature, Light, Depth, Black fly larvae, Substrate, Colonization.

Laboratory and field studies were used in this investigation on the influence of water velocity, substrate depth, substrate type, temperature, amount of light and stream characteristics on colonization and relocation behavior of black fly larvae. Results showed that water velocity, substrate placement and exposure time influenced substrate type selection in the field. Prosimulium mixtum/fuscum attached to either white tiles or clear plastic tapes but Cnephia dacotensis preferred white ceramic tiles. Both species showed a preference for specific velocity ranges. Neither species increased their relocation behavior when exposed to depths varying from 2 to 30 cm or to temperatures of 2 to 30 C. In the absence of light, P. mixtum/fuscum increased relocation behavior. (Chilton-ORNL)
W79-09569

TEMPERATURE SENSITIVITY: A CELL CHARACTER DETERMINED BY OBLIGATE ENDOSYMBIONTS IN AMOEBAS,
Tennessee Univ., Knoxville. Dept. of Zoology.
K. W. Jeon, and T. I. Ahn.
Science Vol. 202, p 635-637, November 1978, 2 fig, 1 tab, 12 ref.

Descriptors: *Environmental effects, *Temperature, Protozoa, Bacteria, Mortality, Symbiosis.

A strain of Amoeba proteus has been developed which is dependent on endosymbiotic bacteria that are psychrophile-like. It was found that these symbiotic amoebas are unable to survive at temperatures above 26C. At 26C, the symbiotic amoebas died out within 2 weeks after having divided more than four times. All the symbionts disappeared from the amoebas by the 7th day of culture at 26C while nonsymbiotic amoebas continued to multiply. (Chilton-ORNL)
W79-09570

LIFE HISTORY OF A MULTIVOLTINE MAYFLY, TRICORYTHODES MINUTUS: AN EXAMPLE OF THE EFFECT OF TEMPERATURE ON THE LIFE CYCLE,
Stearns-Roger, Inc., Denver, CO. Environmental Sciences Div.
R. L. Newell, and G. W. Minshall.
Annals of the Entomological Society of America, Vol. 71, No. 6, p 876-881, November 1978, 11 fig, 1 tab, 24 ref.

Descriptors: *Environmental effects, *Temperature, Life history studies, Mayflies.

Life history of the mayfly Tricorythodes minutus was studied at 2 locations, one of which had a spring source and a relatively constant temperature of 18C and the other of which had a normal seasonal fluctuation in water temperature. Life cycle was unquestionably influenced by temperature with populations at the constant temperature station showing a multivoltine cycle and populations at the other station having a bivoltine cycle. Standing crop was variable, with maxima of 11,250/sq meter at the constant temperature station and 1400/sq meter at the other. At the second station, T. minutus behaves like a tropical insect and has apparently lost some of the accurate controls that a mayfly population normally requires to survive (timing of emergence, etc.). (Chilton-ORNL)
W79-09571

TOWARDS A REALISTIC PREDATOR-PREY MODEL: THE EFFECT OF TEMPERATURE ON THE FUNCTIONAL RESPONSE AND LIFE HISTORY OF LARVAE OF THE DAMSELFLY, ISCHNURA ELEGANS,
York Univ. (England). Dept. of Biology.
D. J. Thompson.
Journal of Animal Ecology, Vol. 47, p 757-767, 1978. 9 fig, 23 ref.

Descriptors: *Environmental effects, *Temperature. *Predation, Insects, Insect behavior, Feeding, Life history studies.

The specific aims of this work were to describe the effect of temperature on the functional response of a common polyphagous aquatic predator, namely penultimate instar larvae of the damselfly Ischnura elegans feeding upon a particular size-class of Daphnia magna and to relate the findings to the life history of Ischnura in the field and to the environmental temperature throughout the year. The attack coefficient was found to increase in a sigmoid manner with temperature while the handling time (time spent: pursuing, subduing, eating, digesting prey) declines logarithmically from 5 to 16C. Field temperature measurements show that onset and termination of growth revolve around a temperature of 8C which corresponds to the temperature in the laboratory experiments at which the attack coefficient begins to increase. (Chilton-ORNL)
W79-09574

A COMPARATIVE ANALYSIS OF THE ACTION OF CONSTANT TEMPERATURES ON THE EMBRYONIC DEVELOPMENT OF FOUR SPECIES OF STURGEONS,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
N. G. Nikol'skaya, and L. A. Sytina.
Journal of Ichthyology, Vol. 18, No. 1, p 86-100, 1978. 3 fig, 3 tab, 37 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Embryonic growth stage, Mortality, Sturgeon.

Development of four species of sturgeon (beluga sturgeon, sheap sturgeon, sturgeon, and sevryuga) were studied at lethal, sublethal, suboptimal, and optimal temperatures. At low sublethal temperatures, beluga eggs perished in the initial stages of division while in other species elimination occurred at later stages. High sublethal temperatures sharply curtailled the life span of beluga and sturgeon eggs. In sheap sturgeon, under the effect of high sublethal temperatures in their entire range, the development of individual, most resistant embryos, continued up to gastrulation. Sublethal temperatures had a double effect on sevryuga. Temperatures approaching lethal (29-30C) suppressed division in its initial stages, others (26-28C) caused the embryos to perish in later stages. With both low and high sublethal temperatures, a considerable period of retardation of development may precede death of the embryos. (Chilton-ORNL)
W79-09575

LABORATORY MEASUREMENTS OF DIGESTION RATE IN 0-GROUP FLOUNDER (PLATICHTHYS FLESUS L.) AT TWO TEMPERATURES,
Copenhagen Univ., Helsingoer (Denmark). Marine Biological Lab.
T. Kiorboe.
Ophelia, Vol. 17, No. 1, p 155-161, July 1978. 2 fig, 12 ref.

Descriptors: *Environmental effects, *Temperature, Model studies, Fish, Feeding, Digestion rate, Flounder.

The principle in the method used in this investigation was to measure the decrease in stomach content as the increase in amount of food needed to refill the stomach. The digestion rate was found to be higher at 15 than at 10C. At 10C the estimate of the rate-constant = 0.14/hour and 15C the rate-constant = 0.21/hour, which means that 13, respectively, 19% of the stomach content is digested every hour. This constitutes a statistically significant difference. (Chilton-ORNL)
W79-09576

SEASONAL LEVELS OF CHLORINATED HYDROCARBONS AND HEAVY METALS IN FISH AND BROWN SHRIMPS FROM THE MEDWAY ESTUARY, KENT,
City of London Polytechnic (England). Dept. of Biological Sciences.
W. L. F. van den Broek.
Environmental Pollution. Vol. 19, No. 1, p 21-38, 1979. 1 fig, 2 tab, 33 ref, 2 append.

Descriptors: *Environmental effects, *Water pollution, Heavy metals, Organic compounds, Fish, Shrimps, Medway estuary, England, Estuaries, Absorption, Bioaccumulation.

Sewage emptying into the Medway estuary is treated but with no facility for removing chlorinated hydrocarbons and heavy metals. This study was undertaken for the purpose of determining base line levels of these pollutants in selected species. Metal concentrations were low and indicated concentrations little more than background levels. Hydrocarbons were higher and showed no marked seasonal variations. (Chilton-ORNL)
W79-09577

SAFE ZINC AND COPPER LEVELS FROM THE SPRING CREEK DRAINAGE FOR STEELHEAD TROUT IN THE UPPER SACRAMENTO RIVER, CALIFORNIA,
California State Dept. of Fish and Game, Rancho Cordova. Water Pollution Control Lab.
B. J. Finlayson, and S. H. Ashuckian.
California Fish and Game, Vol. 65, No. 2, p 80-99, 1979. 2 fig, 6 tab, 27 ref, 4 append.

Descriptors: *Environmental effects, *Water pollution, Metals, Toxicity, Fish, Trout, Mine acids, Copper, Zinc, Mortality.

Sixty day and 96-hr bioassays were conducted on steelhead trout eggs, alevins, and swim-up fry using acid mine waste to determine the necessary dilution factors for safe copper-to-zinc ratios. Eggs were found to more resistant to solutions containing both metals than alevins or fry but solutions of zinc only affected all stages equally. At copper-to-zinc waste ratios of 1:12, copper was absent in solution at partially toxic levels. At copper-to-zinc waste ratios of 1:4, copper was present in sufficient quantities to increase toxicity. Incipient lethal levels in the stages from eggs to fry were .12 mg/1 Zn at the 1:12 ratio and .10 mg/1 Zn and .011 mg/1 Cu at the 1:4 ratio. Incipient lethal level of controls was .03 mg/1 Zn. The presence of aluminum and iron did not appear to affect the toxicity of copper and zinc in the waste. (Chilton-ORNL)
W79-09578

SURVIVAL AND DEVELOPMENT OF ATLANTIC SALMON EGGS AND FRY AT THREE DIFFERENT TEMPERATURES,
Norges Landbrukshoegskole, Vollebekk. Dept. of Animal Genetics and Breeding.
K. Gunnes.
Aquaculture, Vol. 16, No. 3, p 211-218, 1979. 7 fig, 2 tab, 12 ref.

Descriptors: *Environmental effects, *Temperature, Thermal stress, Salmon, Growth stages, Embryonic growth stage, Hatching, Fry.

Groups of Atlantic salmon eggs were incubated at temperatures of 8, 10, and 12 C. At 12 C, mortality was high, fry averaged little more than half the weight of those hatched at the two lower temperatures and development of alevins to swim-up fry was abnormal. Results indicated that the optimum temperature from hatching to swim-up varies according to the temperature experienced during egg incubation. At incubation of 10 C, it was advantageous to reduce the temperature to 8 C for the following period. During the first 6 weeks of feeding, mortality rate was correlated with mortality during earlier development. Total numbers of day-degrees required by eggs and fry to reach eyed, hatching, and swim-up stages were less at 12 C than at 10 or 8 C. Total day-degrees required to reach an average weight of 0.5 or 0.6 g did not vary with temperature during hatching. (Chilton-ORNL)
W79-09579

HEMATOLOGICAL STRESS RESPONSE OF RAINBOW TROUT, SALMO GAIRDNERI, TO A SIMULATED GEOTHERMAL STEAM CONDENSATE SPILL,
California State Dept. of Fish and Game, Sacramento.
J. A. Steele, and L. A. Courtois.
California Fish and Game, Vol. 65, No. 3, p 166-167, July 1979. 7 ref.

Descriptors: *Environmental effects, *Thermal stress, Powerplants, Geothermal studies, Thermal springs, Rainbow trout, Fish kills, Hematology.

Rainbow trout were exposed to a condensate collected from Geysers Power Plant, California, which was diluted with filtered river water. The mixture represented a 15% volume/volume addition to a stream. Blood from the fish was collected at 0, 2, 23, and 93 hrs from the beginning of the exposure. Extreme physiological differences were evident between control and test fish blood parameters. Ammonia and carbon dioxide were high up to 23 hr but returned to pre-test levels by 93 hrs. Dissolved oxygen decreased by 1.0 ppm following introduction of condensate and then returned to pre-test levels. Mean corpuscular hemoglobin concentration increased sharply following addition of condensate, dropped below normal, and then remained significantly above control levels for duration of the test. (Chilton-ORNL)
W79-09580

5D. Waste Treatment Processes

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME III. TECHNICAL APPENDIX,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 846, Price codes: A07 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 150 p.

Descriptors: *Water quality, *Waste water treatment, *Waste water disposal, *Water pollution treatment, *Costs, *Land treatment, *Water quality management(Applied), *Colorado River Basin(TX), *Texas, Activated sludge treatment, Lime clarification, Nitrification, Biochemical oxygen demand, Runoff, Infiltration, Capital costs, Water pollution, Planning, Tertiary treatment, Primary treatment.

The objective of this study is to develop the most cost-effective strategy to meet stream water quality criteria for the 50-year planning period 1970-2020. The first section of this volume presents a collection of curves used in estimating costs of collection systems and treatment facilities. Data were gathered from both current literature and recent bid tabulations for similar construction. These cost curves include sanitary sewere, lift stations, activated sludge treatment plants, wastewater stabilization ponds, and tertiary treatment plants. Land application of sewage effluent is described and three basic techniques of land disposal discussed. The rationale for designating the treatment level is described. Because advanced treatment facilities are expensive, it becomes necessary to devise a schedule for implementation of advanced wastewater treatment facilities that allows for phasing of construction and funding. Different treatment methods and facilities are described. An evaluation of wastewater treatment process efficiencies is presented. A listing of base data and a bibliography of publications utilized during the study is included, as well as a glossary and water usage parameters. (See also W79-09331) (Coan-NC)
W79-09333

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME V. UPPER BASIN,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 848, Price codes: A12 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 255 p, 9 append, 25 plates, 12 tab.

Descriptors: *Waste water treatment, *Waste treatment, *Water pollution, *Water resources, *Regional planning, *Planning, *Water quality management(Applied), *Waste loads, *Texas, *Colorado River Basin(TX), Land resources, Land use, Solid waste, Hydrology, Geology, Costs, Capital costs, Operating costs, Maintenance costs, Economics, Population, Soils, Land treatment, Odessa(TX), Midland(TX), Big Spring(TX).

The objective of this study is the development of the most cost-effective strategy to meet stream water quality criteria for the 50-year planning period 1970-2020. This volume contains the areawide planning documents pertaining to the Upper Colorado Basin Planning Area primarily covering the planning jurisdiction of the Permian Basin Regional Planning Commission (PBRPC). Three communities in the PBRPC jurisdiction are described in detail--Big Spring, Midland and Odessa. The general characteristics of the PBRPC region are presented--physical and socio-economic--along with existing waste loads. The three metropolitan areas are described; descriptions of water resources and supply, waste load analysis, industrial wastes and waste load allocation, and municipal wastewater collection and treatment systems are presented. Twelve alternatives were considered, and, for each municipality, alternative 1 was selected as the best plan. This included modification and expansion of existing facilities and load disposal for Big Spring; use of the existing secondary treatment plant and total irrigation as currently practiced for Midland; and expansion of the existing secondary treatment plus industrial reuse of effluent for Odessa. The municipalities' wastewater collection systems, proposed collection systems and their costs, and existing wastewater treatment systems and some alternatives are described, as well as detailed economic and evaluation analyses of the proposed alternatives. Areawide plans are also presented for nine other communities in the PBRPC jurisdiction. A description is presented of the South Plains Association of Governments (SPAG) and areawide plans presented for six communities within its jurisdiction. (See also W79-09331) (Coan-NC)
W79-09335

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME VI. CENTRAL BASIN,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 849, Price codes: A16 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 365 p, 6 append, 40 plates, 16 tab.

Descriptors: *Waste water treatment, *Waste treatment, *Water pollution, *Regional planning, *Planning, *Water quality management(Applied), *Water resources, *Texas, *Colorado River Basin(TX), *Waste loads, Solid waste, Hydrology, Geology, Costs, Capital costs, Operating costs, Maintenance costs, Economics, Population, Soils, Sewerage, Land use, Land resources.

The objective of this study is the development of the most cost-effective strategy to meet stream water criteria for the 50-year planning period 1970-2020. This volume contains the areawide planning documents pertaining to the Central Basin Planning Area. The scope of the study covers the planning areas of the Alamo area, Central Texas, Concho Valley, West Central Texas Councils of Governments, and Middle Rio Grande Development Council. For each planning council, the report describes their respective planning authority, the physical characteristics of each planning area, the socio-economic characteristics, and existing wasteloads. Physical characteristics described include climate, hydrology, water resources, and geology, and socio-economic characteristics are comprised of population, land use and each area's economic base. The areawide plans of the most important non-metropolitan areas are described. This plan contains a discussion of water use, waste load, and population projections, and influent-effluent data. Some regional councils contain major metropolitan areas and the respective areawide plans for these jurisdictions are presented. The report presents the municipalities' wastewater collection systems, proposed collection systems and their costs, existing wastewater treatment systems, and alternatives to the treatment system. The appendices present a detailed economic and evaluation analysis of the alternatives including cost summaries and comparisons, and environmental, social, and economic impacts of the alternatives. (See also W79-09331) (Coan-NC)
W79-09336

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME VII. LOWER BASIN,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 850, Price codes: A19 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 433 p, 5 append, 47 plates, 48 tab.

Descriptors: *Waste water treatment, *Waste treatment, *Water pollution, *Water resources, *Regional planning, *Planning, *Texas, *Colorado River Basin(TX), *Austin(TX), Travis County(TX), Waste loads, Land resources, Land use, Solid waste, Hydrology, Geology, Costs, Capital costs, Operation costs, Maintenance costs, Economics, Population, Soils, Sewerage, Water quality management(Applied).

The objective of this study is the development of the most cost-effective strategy to meet stream water criteria for the 50-year planning period 1970-2020. This volume contains the areawide planning documents pertaining to the lower Basin covering the planning jurisdictions of the Capital Area Planning Council (CAPCO) and the Houston-Galveston Area Council (H-GAC). First, the CAPCO planning jurisdiction is described--its institutional structure, a physical and socio-economic description of the area, population analysis and projections, water use requirements and water supplies, and existing industrial and agricultural operations and their waste loads. An in-depth look at the metropolitan plan for Austin is then presented, with descriptions of the topography, geology, population projections, water resources, existing sewerage collection and treatment systems, agricultural and urban runoff, and proposed wastewater collection and treatment systems. An economic and evaluation analysis of alternatives to the existing wastewater collection system with cost comparisons, and summaries and various impacts of the alternatives is presented, as well as an evaluation of land disposal methods. Plans are presented for each of the public wastewater treatment facilities in the non-metropolitan areas of CAPCO to meet federal water quality standards in the most cost-effective manner. The basic criteria for these plans are population projections, waste loads, degree of treatment, and cost. The areawide plan for H-GAC area is presented which is similar in scope to the CAPCO plan but with fewer non-metropolitan areas. (See also W79-09331) (Coan-NC)
W79-09337

NASA JSC WATER MONITOR SYSTEM--CITY OF HOUSTON FIELD DEMONSTRATION,
National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.
R. E. Taylor, E. L. Jeffers, and D. H. Fricks.
Report No. NASA RP-1041, July 1979. 55 p, 17 fig, 13 tab, 2 append.

Descriptors: *Water quality, *Reclaimed water, *Water reuse, *Monitoring, *Effluents, Houston(Texas), Bioluminescence, Domestic water, Biosensors, Coliforms, Water sampling, Waste identification, Coliforms, Water sampling, Waste identification, Microorganisms, Chemiluminescence, Sewage treatment.

A system to perform automated water quality monitoring on-line and in real time, much as it would be done in a spacecraft was developed. The system has the capability to determine conformance to future high effluent quality standards and to increase the potential for reclamation and reuse of water. Included in the system are conventional commercial sensors, advanced organic sensors, NASA-developed microorganism sensors, an automated sample collection system, and a data acquisition and display system that also has the capability to automatically control and standardize the sen-

sors. Following a description of the system, test support, field testing, and results are discussed. Field testing was designed to demonstrate system operation and effectiveness in monitoring in-process fluid and effluent from an actual wastewater treatment facility. Fully automated operation over a sustained period which only routine manual adjustments was accomplished. Sensors were calibrated under softwave control and returned to service for continuous monitoring. Reports were generated on an hourly basis from data stored on disks. Results show that the monitoring system has great potential in water monitoring and for process control applications and that it represents a vast improvement over conventional (grab sample) water monitoring techniques. (Seigler-IPA)
W79-09432

TREATMENT OF WASTE WATER,
British Oxygen Co. Ltd., London (England). (Assignee).
K. C. Smith, and M. E. Garrett.
U.S. Patent No. 4,141,823, 7 p, 5 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1425-1426, February 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Aerobic conditions, Aerobic bacteria, Oxygen, Biochemical oxygen demand, Equipment.

A process for treating aqueous waste material having a biochemical oxygen demand comprises passing the aqueous waste material along an elongate treatment tank or other elongate container. The container has a transverse support structure or structures extending along its length to support aerobic microorganisms. The support structures can take the form of spaced apart pieces of wire mesh or coiled strand-like material with passages for liquid flow. Preferably the support structures are removable from the tank for cleaning purposes. An oxygenating gas is introduced into the interior of the container at a number of positions spaced along its length. (Sinha-OEIS)
W79-09509

TREATMENT OF ACRYLONITRILE WASTE WATER WITH ACTIVATED CARBON,
Standard Oil Co. (OH), Cleveland. (Assignee).
H. E. Alford, and K. L. Bigler.
U.S. Patent No. 4,141,826, 8 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1426-1427, February 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Organic wastes, Activated carbon, Adsorption, Regeneration, Product recovery, Acrylonitrile.

Waste water from an acrylonitrile-manufacturing plant is contacted with activated carbon in a series of activated carbon beds so that valuable organic components in the waste stream, e.g. acrylonitrile and acrylic acid, are adsorbed. The waste water passing out of the activated carbon beds can be distilled if desired without encountering the fouling problem associated with distilling raw acrylonitrile waste water so that the volume of waste water which must be discharged is significantly reduced. The activated carbon is periodically regenerated with a desorbing liquid and the desorbate product is distilled to yield acrylonitrile and acrylic acid. Every fifth regeneration cycle, the activated carbon is regenerated thermally rather than by means of a liquid in order to restore its activity to its original value. (Sinha-OEIS)
W79-09512

PROCESS FOR CLARIFYING COAL WASH WATERS,
American Cyanamid Co., Stamford, CT. (Assignee).
A. T. Coscia, and M. N. D. O'Connor.
U.S. Patent No. 4,141,827, 6 p, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1427, February 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Separation techniques, Suspended solids, Water purification, Polymers, Flocculation, Coal wash waters, Low molecular weight polymers.

A process is provided for settling suspended solids in coal washing waste water which comprises mixing with the water an effective amount of a polymer of low molecular weight. The low molecular weight polymers provide small absorbent flocs which can absorb additional suspended solids and provide greater clarification. After the polymer has been mixed with the waste water, the solids are settled to provide a clarified supernatant liquid which may be separated from the settled solids by suitable means, such as by decantation, filtration, centrifugation and the like. (Sinha-OEIS)
W79-09513

PROCESS FOR TREATING WASTE WATER,
Osaka Gas Co. Ltd. (Japan). (Assignee).
N. Okada, Y. Nakanishi, and Y. Harada.
U.S. Patent No. 4,141,828, 9 p, 2 fig, 9 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1427, February 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Ammonia, Nitrogen, Industrial wastes, Oxidation, Oxygen, Chemical oxygen demand, Catalysts, Wet oxidation.

A process for treating ammonia-containing waste water comprises subjecting the ammonia-containing water to wet oxidation with an oxygen-containing gas in the presence of a catalyst while maintaining the waste water at a temperature of 100 to 370 degrees C and at pressure permitting the waste water to remain in the liquid phase. The catalyst comprises at least one of iron, cobalt, nickel, ruthenium, rhodium, palladium, iridium, platinum, copper, gold, tungsten and compounds of these metals which are insoluble in water. It is preferable to remove suspended solids partly or wholly from the waste water prior to the treatment depending on the concentration and composition of the solids. (Sinha-OEIS)
W79-09514

PROCESS FOR WET OXIDATION OF ORGANIC SUBSTANCES,
Farbenfabriken Bayer A. G., Leverkusen (Germany, F.R.).
R. Thiel, K-H. Dietz, H. Kerres, and H. J. Rosenbaum.
U.S. Patent No. 4,141,829, 8 p, 1 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1427-1428, February 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Organic wastes, *Water pollution treatment, *Oxidation, Oxygen, Separation techniques, Evaporation, Carbon dioxide, Wet oxidation.

A process has been developed for the oxidation of organic substances, dissolved or dispersed in an aqueous system, with a gas containing molecular oxygen at elevated temperature and under elevated pressure chiefly to carbon dioxide and water, with subsequent phase separation of the reaction mixture into a gaseous phase substantially containing inert gas, carbon dioxide, steam and organic constituents and a liquid phase substantially containing water, characterized in that the pressure is adjusted, at the given temperature, so that by evaporation of water from the aqueous system, more steam than the exothermicity of the oxidation reaction gives rise to, goes into the gaseous phase, which is fed to a heat exchanger in which the amount of heat required to maintain the oxidation temperature is completely or partially transferred to a mixture of water and a gas containing molecular oxygen, which mixture flows in on the other side of the heat exchanger and is subsequently fed to the reactor. A particular advantage of the process is that, in addition to the oxidation of organic substances, it is possible to feed inorganic constituents, after the oxidative degradation of the organic substances, to a re-use or recovery process. (Sinha-OEIS)
W79-09515

MEMBRANE SEPARATION OF WATER FROM AQUEOUS MIXTURES,
Monsanto Co., St. Louis, MO. (Assignee).
For primary bibliographic entry see Field 5G.
W79-09520

METHOD AND APPARATUS FOR MECHANICALLY AND CHEMICALLY TREATING LIQUIDS,
Passavent-Werke Michelbacher Huette, Aarbergen (Germany, F.R.). (Assignee).
G. von Hagel, and N. Berlenbach.
U.S. Patent No. 4,142,970, 10 p, 5 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 244, March 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Flocculation, Flow, Equipment, Sedimentation zone.

A new and improved method for treating waste water by a mechanical and chemical technique is described. Liquid to be treated flows into a combined sedimentation and thickening tank. The upper part of the tank is a sedimentation zone in which the liquid passes through parallel flow paths between downwardly inclined separator plates below which the solids fall to the bottom of the tank into the thickening zone where the solids are stirred and removed by a suitable stirring and scraping device. The liquids flowing with the solids through the parallel paths are removed at the end of the paths and delivered directly to the top of the sedimentation zone thus leaving the thickening zone essentially flow-free. Flocculants may be added to the water to be treated in a separate flocculation compartment arranged upstream from the sedimentation compartment. A separate destabilization compartment may be provided upstream from the flocculation compartment. A square sedimentation zone may merge smoothly into a circular thickening zone. The thickening zone may extend beneath the flocculation compartment for compactness. The scraping and stirring device may be rotatable or movable along a straight path. (Sinha-OEIS)
W79-09522

APPARATUS FOR THE TREATMENT OF SEWAGE,
Sanilogical Corp., Denver, CO. (Assignee).
J. Kinzer.
U.S. Patent No. 4,142,975, 13 p, 10 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 246, March 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Aerobic conditions, Organic wastes, Mixing, Oxygenation, Microorganisms, Equipment, Autodigestion.

An apparatus for treating sewage to obtain substantially complete organic matter substrate and biological sludge oxidation prior to effluent discharge comprises a series of treatment units. Each unit has a generally circular cross-section configuration and means for providing fluid communication between each successive unit of the series. The system provides for a uniform, complete and thorough intermixing of mixed liquor and suspended solids throughout each treatment chamber thereby eliminating the settling of any biological sludge. It also provides for uniform dispersal and intimate contacting of oxygen with mixed liquor and suspended solids throughout the treatment chamber thereby providing a suitable environment for continuous aerobic activity of microorganisms. Serial fluid communication between units of the series provides an environment suitable for organic matter substrate consumption and microorganism generation and development in an initial unit of the series, an environment suitable for microorganism population maintenance in an intermediate unit of the series, and an environment suitable for forced autodigestion of the microorganisms in the latter units of the series, thereby eliminating biological sludge produced in the microorganism development phase. (Sinha - OEIS)
W79-09523

METHOD FOR WORKING UP AQUEOUS RESIDUES FROM METALLIZING BATHS,
Brown, Boveri and Co. Ltd., Baden (Switzerland). (Assignee).
H. Bollhalder, and V. Sova.
U.S. Patent No. 4,144,149, 5 p, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 2, p 631, March 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Separation techniques, Metals, Copper, Heavy metals, Electrolysis, Anion exchange, Chelating agents, Ethylenediaminetetraacetic acid(EDTA).

The object of this invention is to provide a technique for purifying aqueous residues from exhausted metallizing baths, especially coppering baths which operate without external current, which contain at least one amino compound as a complex-forming agent or chelating agent, to produce an effluent virtually free from heavy metal ions such that it can be fed without dilution into the communal sewerage system or a drain. This and other objects have been achieved by the method where aqueous residue containing heavy metal ions and an amino-containing compound as a complex-forming agent, as the free acid or as a salt, is subjected to an anodic treatment in order to eliminate the complexing ability of the amino compound. The anodic treatment is preferably carried out as an electrolysis of the aqueous residue, and deposition of the heavy metal on the cathode can take place simultaneous with anodic treatment. (Sinha - OEIS)
W79-09526

SEWAGE TREATMENT SYSTEM,
A. L. Burkett, and A. O. Nelson.
U.S. Patent No. 4,144,167, 12 p, 8 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 2, p 635, March 13, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Separation techniques, Centrifugation, Aeration, Impaired water quality, Reclaimed water, Equipment, Fertilizers.

The sewage treatment system includes an evacuator means for extracting raw aquaous sewage from sewer pipes, or other sources, and supplying the extracted sewage to an especially configured centrifugal mill. The centrifugal mill applies high speed mechanical forces to the incoming sewage for disintegration of the solids and thorough aeration of the liquids. The flow rate of the incoming sewage through the centrifugal mill is maintained at a rate which assures that the mill's rotors are not required to operate under an aqueous medium and air is admitted to the mill in sufficient amounts to insure complete aeration. In this manner, the drive equipment size and power consumption are held to a minimum and relatively high rotor speeds are attainable to cause introduction of large quantities of air which satisfies the biochemical oxygen demand of the sewage and produces odor free by-products. The odor free by-products emerge tangentially from the centrifugal mill and are fed through a self cleaning screen means which separates the disintegrated or pulpy solids and delivers reclaimed water which can then be used for crop irrigation, equipment cooling and the like. (Sinha-OEIS)
W79-09527

APPARATUS FOR WATER TREATMENT,
K. R. Dunkers.
U.S. Patent No. 4,144,170, 10 p, 7 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 2, p 636-637, March 13, 1979.

Descriptors: *Patents, *Water treatment, *Water pollution treatment, Sewage treatment, Separation techniques, Floating, Aeration, Flow separation, Baffles, Storm water, Equipment.

An apparatus for treatment of water comprises inclined lamellae arranged so that settling materials as well as floating materials are separated from the water. The apparatus is devised so that the water flows in opposite directions through separate spaces between the lamallae, wherein heavy materials (sludge) settle to the bottoms of the spaces while floating materials (scum) are retained and separated in a chamber where the water changes its direction of flow. The apparatus may be arranged for separation of sludge in two fractions and for purification of the water by a combination of flotation by aeration and settling. The apparatus is useful for all types of purification processes based on separation by settling and flotation within the water and sewage treatment art. Especially of interest is the favorable application of the apparatus for treating storm water and overflow water. (Sinha-OEIS)
W79-09528

MODULAR DRAIN FIELD SECTION,
D. J. Lascelles.
U.S. Patent No. 4,145,157, 5 p, 5 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 974, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Soil disposal fields, Sewage treatment, Domestic wastes.

A modular drain field section and a method for making a drain field section are disclosed having upper and lower casings which are connected together to form each drain field section. Both upper and lower casings have a center pipe portion which, when connected together, forms a central pipe and each casing has troughs on both sides of the center pipe portion. The lower casing troughs have openings and a spillway connects the central pipe with the lower casing troughs. The modular drain field sections are connected together to form a drain field without the use of rock media, fill, drain tile, grace board or felt paper. A method of making the modular drain field sections includes using the same mold both for the upper and lower casings. (Sinha-OEIS)
W79-09529

WATER RECYCLING SYSTEM,
Pure Cycle Corp., Boulder, CO. (Assignee).
H. W. Selby, III.
U.S. Patent No. 4,145,279, 8 p, 3 fig, 22 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1013-1014, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Monitoring, *Control systems, Water utilization, Water reuse, Domestic wastes, Ion exchange, Recirculated water, Water conservation, *Closed recycling system, Regeneration, Ultrafiltration.

A closed water recycling system produces potable drinking water from total domestic waste-water, including household sewage. A microprocessor monitors the operation of the system and automatically back-flushes the ultra-filter assembly, regenerates the ion exchange bed when the monitored variables indicate that this is necessary, and acts as a failsafe monitor to insure water quality by shutting down the system in case of a malfunction. For example, the bed includes acid and base regenerated resins having different specific gravities. When a monitor indicates that the bed requires regeneration, a water flush separates resins by specific gravity. Acid and base regenerating solutions are supplied to opposite sides of the bed. The flow of regenerating solution is stopped when the salt band produced during regeneration approaches an outlet at the middle of the bed. By stopping regeneration before excess regenerative has entered the bed, a saving in regenerating solution is effected and reduction in rinse water is effected, keeping the water losses from regeneration to a minimum. (It is desireable to have only a small amount of by-product water of high salt content to dispose of.) In a preferred embodiment, a rotational digestor has a wheel which evaporates the waste-water solution. (Sinha - OEIS)
W79-09531

METHOD AND DEVICE FOR SEPARATING A MIXTURE,
Ballast-Nedam Groep N.V., Amstelveen (Netherlands). (Assignees); and Skimovex B.V., Hague (Netherlands). (Assignees).
C. G. Middelbeek, M. E. Polano, and T. A. Wolters.
U.S. Patent No. 4,145,280, 17 p, 26 fig, 13 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1014, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Filtration, Coagulation, Equipment, Flushing, Regeneration.

A method of separating a mixture of a carrier medium and at least one insoluble substance is described, for example, water and oil or gas and soot, in which the mixture is separated in three steps. In a first step the mixture is passed for coalescence of the substance through a first packet of moving filter material. In a second step the substance coalesced segregates from the mixture by gravity and in a third step the remainder of the substance and the other packet of filter material is filtered out. The invention furthermore provides a device specifically intended to separate a mixture by carrying out the method. (Sinha - OEIS)
W79-09532

PROCESS FOR PURIFYING WASTE WATER CONTAINING FLUORIDE ION,
Andco Industries, Inc., Cheektowaga, NY. (Assignee).
S. Bruckenstein.
U.S. Patent No. 4,145,282, 8 p, 4 tab, 8 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1014, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Fluorides, Separation techniques, Chemical precipitation, Calcium, Phosphates, Fluorapatite.

A process for purifying waste water containing fluoride comprises precipitating fluoride from the waste water as fluorapatite. Fluoride is removed as fluorapatite by having sufficient available calcium for each mole of fluoride present in the waste water and sufficient available phosphate for each mole of fluoride in the waste water to form a precipitate which is or converts to sufficient fluorapatite to remove essentially all fluoride from the waste water. The precipitate which forms in a waste water stream as a result of either the continuous or batch process of the invention may be removed by passing the waste water through a settling tank having sufficient residence time to permit the precipitate to be removed by settling or alternatively the waste water may be passed through a filter or centrifuge to remove the precipitate. (Sinha-OEIS)
W79-09534

AUTOMATIC SYSTEM FOR TRAPPING AND REMOVING WASTE HYDROCARBONS FROM WATER,
F. P. Bereskin, and J. J. Borowczyk.
U.S. Patent No. 4,145,286, 6 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1015-1016, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, Oil wastes, Separation techniques, Specific gravity, Oil-water interfaces, Control systems, Hydrocarbons.

A system for waste oil recovery by flotation includes a main collection chamber for receiving influent waste water including oil, grease and other hydrocarbons, so that the hydrocarbons, having a lesser specific gravity than water and immiscible in water, will float, becoming an upper layer, the water settling in the chamber to become a lower layer. A water outlet regulates discharge of the water from the main collection chamber to keep the water at a desired level. A waste outlet regulates discharge of the hydrocarbons from a discharge opening or vent which is at a higher level or height than the water outlet. A control means is provided for automatically initiating the waste removal cycle by controlling the outlet and inlet

opening to admit fluid to raise the waste level and discharge and waste hydrocarbons through the discharge opening. The waste removal cycle is then automatically terminated and the collection chamber is returned to a normal flow-through operation. (Sinha-OEIS)
W79-09535

PROCESS FOR THE PURIFICATION OF WASTE WATER,
Hoechst A. G., Frankfurt au Main (Germany, F.R.).
A. Topp, K. Schmiedel, and G. Schaeffer.
U.S. Patent No. 4,145,283, 5 p, 3 tab, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1014-1015, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Chemical wastes, Water purification, Separation techniques, Oxidation, Oxygen, Temperature, Pressure, Chemical precipitation, Byproducts, Wet oxidation.

A process is provided for purifying waste waters formed by the preparation of hydroxy aromatics by a caustic alkaline melt of aryl-sulfonic acids or arylsufonates that is not only simple and economical, but also provides, as by-product, a salt of sufficient purity that is suitable for further direct use. The waste liquor is subjected to a wet oxidation process with oxygen or oxygen-containing gases at elevated temperature and under elevated pressure. (Sinha-OEIS)
W79-09536

GREASE AND WATER SEPARATING APPARATUS,
H. L. Walker, and D. B. David.
U.S. Patent No. 4,145,287, 11 p, 12 fig, 16 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1016, March 20, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Industrial wastes, Equipment, Specific gravity, Byproducts, Grease.

An apparatus separates grease from a waste effluent containing a grease and water mixture prior to disposing of the effluent in a sanitary sewage system. A separator tank receives and holds the effluent while the mixture separates into an upper grease fraction and a lower water fraction. A means is provided for introducing the effluent into the tank either periodically or directly from the source of the effluent. A withdrawal means is associated with the tank for withdrawing at least a portion of the water fraction from the tank when the effluent in the tank reaches a predetermined level. The withdrawal means stop withdrawing the water fraction when the effluent in the tank reaches a second predetermined level lower than the first level. The grease can be stored in the separator tank itself or can be transferred to a separate storage tank. The water is disposed of directly to the sewer system while the grease is periodically collected for reprocessing into usable byproducts. (Sinha-OEIS)
W79-09537

A REVIEW OF THE ENVIRONMENTAL IMPACT OF GROUND DISPOSAL OF OIL SHALE WASTES,
Battelle Pacific Northwest Labs., Richland, WA.
R. C. Routson, R. E. Wildung, and R. M. Bean.
Journal of Environmental Quality, Vol. 8, No. 1, p 14-19, 1979. 52 ref. DOE EY-76-C-06-1830.

Descriptors: *Environmental effects, *Water quality, Energy, Waste disposal, Mining, Groundwater, Oil shale extraction.

This review considers waste disposal methods for the major types of oil shale extraction process, the potential environmental impacts of waste disposal, mitigation of environmental effects, and further research needs. Retort waters, which are the principal wastes scheduled for ground disposal, contain complex, soluble organic components and the spent shales contain potentially leachable salts and organic pyrolytic products. It is suggested that current research should be directed to source characterization and monitoring, ground disposal methodology, hydrologic transport, and environmental effects. (Chilton-ORNL)
W79-09572

5F. Water Treatment and Quality Alteration

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME I. BASIN PLAN,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 844, Price codes: A23 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 534 p, 23 fig, 74 plates, 23 tab.

Descriptors: *Water quality, *Water pollution, *Water resources, *Waste water treatment, *Waste water sources, *Water quality management(Applied), *Texas, *Colorado River Basin(TX), Water requirements, Land use, Geology, Irrigation, Hydropower, Mining, Archaeological resources, Fish, Wildlife, Climate, Planning, Urban runoff, Non-point pollution, Water pollution sources.

The objective of this study is the development of the most cost-effective strategy to meet stream water quality criteria for the 50-year planning period, 1970 to 2020. Alternatives considered include strategies and projects to approach no discharge of pollutants by 1985. The scope includes water resources, water quality, definition of the study area, wastewater sources, and alternatives for achieving water quality. The Colorado River Basin in Texas encompasses about 39,900 square miles extending across several basic physiographic provinces. The 1970 population was 834,747; predominant land use was range and unimproved pasture land and farming. Major water quality problems are stream imbalance caused by disproportionate amounts of secondary effluent and quality degradation caused by inflow of mineral salts. The only pollution-abatement measures initiated have been municipal secondary sewage treatment plants and industrial treatment facilities. The feasible alternatives for meeting water quality objectives in the study area include treatment, relocation of discharge, water re-use, and control of wastewater quantities by zoning and planned growth. Alternative funding levels and recommended funding levels are presented. The 'treatment' alternative is recommended, in conjunction with re-use and regionalization. (See also W79-09332 thru W79-09337) (Coan-NC)
W79-09331

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOL. II. BASIN PLAN APPENDIX,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 845, Price codes: A16 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 365 p.

Descriptors: *Texas, *Waste water management, *Planning, *Population projections, *Ground water, *Ground water availability, *Waste water treatment, *Mathematical models, *Modeling, *Water quality control, *Colorado River Basin(TX), *Waste loads, Oil industry, Water pollution, Minerals, Advanced waste treatment, Simulation, Legal aspects, Regulations, Conservative minerals, Water quality standards, Public participation.

The objective of this study is the development of the most cost-effective strategy to meet stream water quality criteria for the 50-year period 1970 to 2020. This volume is an appendix to the Basin Plan presented in Vol. I. Population projections are made for the study area on three levels--county, representative cities, and selected rural areas. A listing of river mile keys is included. Ground water availability is discussed. The Basin is underlain by nine ground water reservoirs; the characteristics of each reservoir are presented. Oil and gas producing leases are investigated; the methodology used in the development of discharges ranking lists is presented. Waste level allocations for conservative minerals are set forth and the priority listing methodology developed for the report is discussed. The development and calibration of the water quality model for the Colorado River below Austin is presented verbatim, as are selected Texas Water Quality Board Regulations and proposed water quality standards for the Colorado River. The public involvement program is set out, including reports of public meetings and workshops. (See also W79-09331) (Cooper-NC)
W79-09332

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME III. TECHNICAL APPENDIX,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09333

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME IV. INSTITUTIONAL ARRANGEMENTS,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 6E.
W79-09334

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME V. UPPER BASIN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09335

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME VI. CENTRAL BASIN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09336

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME VII. LOWER BASIN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09337

TANGENTIALLY FED UPFLOW SAND FILTER METHOD AND APPARATUS,
Midcon Pipeline Equipment Co., Houston, TX. (Assignee).
C. K. Smith.
U.S. Patent No. 4,141,824, 10 p, 7 fig, 25 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1426, February 27, 1979.

Descriptors: *Patents, *Water purification, *Water pollution treatment, *Filtration, Filters, Separation techniques, Sands, Biological treatment, Chlorination, Backwash.

Methods and apparatus for purifying water by filtration are described. Water is passed in an upward direction through one or more sand beds supported in towers, at a slow rate of flow so that the sand bed is not disturbed. The sand bed or layer is relatively deep vertically to provide superior filtration. Raw water feed to each tower is accomplished by tangential flow from the inlets. Rapid backwash of the sand bed is accomplished by opening a dump valve at the lower end of a cone provided at the base of the tower in which the sand bed is supported. Maintenance and control of bacterial activity in the lower part of the sand bed enhances purification of the water by bacterial action. Chemical treatments of the water may be used in conjunction with the filtration, including treatments with chlorine, and with alum (i.e. aluminum sulphate and/or potassium or am-

monium alum) to produce a floc, and barius sulphate and/or a drilling mud may be added to assist in removal of the floc by filtration. (Sinha-OEIS)
W79-09510

OZONE/ULTRAVIOLET WATER PURIFIER,
Ontario Research Foundation, Mississauga. (Assignee).
A. J. Last.
U.S. Patent No. 4,141,830, 5 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1428, February 27, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, Ultraviolet radiation, Ozone, Disinfection, Water quality control, Equipment.

Small amounts of ozone can be produced by an ultraviolet lamp which is simultaneously irradiating the water, and this small quantity of ozone is combined in the flowing water. This will place some residual ozone in the water for maintaining disinfection downstream of the irradiation location and will allow simultaneous disinfection with ozone and with ultraviolet. The apparatus consists of an ultraviolet light source which irradiates air passing through a first chamber surrounding the source, and then irradiates the liquid passing through the second chamber surrounding the first chamber. The air from the first chamber is ozonated by the ultraviolet light, and this air is bubbled into the water in the second chamber to maximize the purification through simultaneous ultraviolet and ozone exposure. (Sinha - OEIS)
W79-09516

5G. Water Quality Control

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME I. BASIN PLAN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5F.
W79-09331

PLANNING WATER USE AND QUALITY CONTROL IN A RIVER BASIN,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 6A.
W79-09436

MULTILEVEL APPROACH TO URBAN STORM WATER SYSTEMS PLANNING,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6A.
W79-09488

POLLUTION CONTROL MANUAL FOR IRRIGATED AGRICULTURE,
Toups Corp., Loveland, CO.
For primary bibliographic entry see Field 3F.
W79-09490

CROPPING AN ABANDONED FEEDLOT TO PREVENT DEEP PERCOLATION OF NITRATE-NITROGEN,
Science and Education Administration, Cheyenne, WY.
G. E. Schuman, and L. F. Elliott.
Soil Science, Vol. 126, No. 4, p 237-243, October, 1978. 6 fig, 2 tab, 6 ref.

Descriptors: *Nitrogen, Nitrates, Feed lots, Water quality control, *Groundwater, *Leachate, Crop production.

An abandoned feedlot was cropped to corn (Zea mays L.) and alfalfa (Medicago sativa L.) to prevent excess buildup and deep percolation of NO3-N from the organic and NH4-N accumulations from the feedlot operation. To eliminate part of the N and salt accumulations, 15 cm of surface material was removed from half the plots and replaced with field soil. Alfalfa production was 14.1 and 11.8 metric tons/ha, and corn forage production was 8.0 and 6.7 metric tons/ha, from the intact surface and removed surface treatments, respectively. Nitrogen uptake was two and one-half to three times greater for alfalfa than for corn, which was reflected by the NO3-N content of the respective soil profiles. Nitrate-N content of the corn forage exceeded 2000 ppm (above the acceptable limit for livestock consumption), whereas the alfalfa averaged only 857 ppm, which would allow using it as a feed without ensiling. Nitrate buildup in the soil profiles was greater when the surface material remained in place; the results indicated that with proper cropping, however, either method would prevent excess NO3-N accumulation. (Skogerboe-Colorado State)
W79-09500

OCEAN OIL SKIMMER FOR CONTINUOUS REMOVAL OF OIL FROM THE OPEN SEA METHOD,
Texaco Inc., New York. (Assignee).
I. C. Pogonowski, and J. R. Fowler.
U.S. Patent No. 4,136,008, 8 p, 9 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 978, no 4, p 1384, January 23, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Water quality control, Oil spills, Specific gravity, Flow, Skimming, Equipment.

A method is disclosed for continuously removing a film of pollutant, as oil, from floating on the water solely by gravity forces. The apparatus comprises a closed top collecting vessel or tank of water elevated above the oil recovered water with a large conduit extending from the bottom of the tank down into the oil, so that as the oil continuously and uninterruptedly floats up internally of the conduit and tank to the top of the tank, the water is simultaneously and continuously displaced and sinks down through the tank and conduit to the water below. With a number of tanks filled with water mounted not higher than 33 feet on a barge being pulled behind a barrier for gathering and banking up the oil just ahead of the barge, a floating pollutant or oil removal system is formed by extending conduits from the bottoms of the water tanks sloping downwardly over the barrier into the floating oil. After establishing a continuous exchange of the oil for the water in the tank by continuous gravity flow of both the oil and the water through the interconnecting conduit in opposite directions simultaneously, the conduit lower end may then be lowered slightly below the interface between the oil and the water, particularly when inadvertently lowered as the layer of oil becomes thin, for continued replacement of the water in the tank with the oil from below. As the oil rises continuously in the conduits and tanks to the top of the tanks, the water simultaneously and continuously sinks down to the water below to accordingly pick up only pollutants of lower density than water, as oil or oil emulsions. (Sinha-OEIS)
W79-09506

AQUATIC DEBRIS REMOVING SYSTEM,
R. H. Gainey.
U.S. Patent No. 4,141,308, 7 p, 4 fig, 13 ref; Official Gazette of the United States Patent Office, Vol. 979, No. 4, p 1260, February 27, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Oil pollution, Flotsam, Mechanical equipment, Jets, Scooping, Air jet propulsion.

An improved mobile scooping and loading machine used to remove floating debris from waterways regardless of the depth of the water consists of a boom-operated scoop. Its interaction with an air jet propelling mechanism is used first to collect the debris to be removed, second to accumulate any floating hydrocarbon slicks onto the surface of the debris, and third to counterbalance the weight of the load to be transported to the disposal site by use of a horizontal runner placed behind the air jet propelling mechanism. (Sinha - OEIS)
W79-09507

MEMBRANE SEPARATION OF WATER FROM AQUEOUS MIXTURES,
Monsanto Co., St. Louis, MO. (Assignee).
E. Perry.
U.S. Patent No. 4,142,966, 5 p, 1 tab, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 244, March 6, 1979.

Descriptors: *Patents, *Water treatment, *Waste water treatment, *Water quality control, *Separation techniques, Water purification, Membrane processes, Permselective membranes, Desalination.

Water is separated from aqueous mixtures through the use of polymeric membranes selectively permeable to water, together with a water miscible sweep liquid having a critical phase separation temperature with respect to water within the thermostability range of the membrane. An essential feature of the water-separation process is that the water miscible liquid have a normal or inverted, thermal-water miscibiligy curve. The selection of the water-miscible liquid promotes a separation process wherein a minimum energy input is required for the separation of water from the sweep liquid, without the necessity of a change in phase. An additional essential feature is that the polymeric membrane be selectively permeable to water as compared to other components. The process has the following steps: (1) contacting aqueous mixtures with a first surface of a polymeric membrane selectively permeable to water; (2) permeating a portion of the water into and through the membrane; (3) contacting a second surface of the membrane with a water miscible liquid having a thermally dependent water miscibility within the stable temperature range of the membrane; (4) withdrawing a water enriched miscible liquid from the second membrane surface; and (5) forming a water rich phase and a miscible liquid phase through the thermal adjustment of the withdrawn water-enriched miscible liquid. (Sinha-OEIS)
W79-09520

COMPOSITION AND PROCESS FOR SELECTIVELY REMOVING OLEAGINOUS PRODUCTS FROM WATER,
R. S. Funk, D. W. Mogg, and D. L. Ruff.
U.S. Patent No. 4,142,969, 5 p, 1 tab, 8 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 244, March 6, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Water quality control, Oil spills, Absorption, Cellulose, Selectivity, Oleophilic properties, Expanded volcanic glass.

This invention provides a composition comprising a specific volcanic glass and vegetable fibers, like cellulosic fibers, both of which are normally nonselectively oleophilic and hydrophilic, to sorb selectively oil from water. The composition is characterized further by having essentially spheroidal spaces or voids and elongated spaces, the former in the expanded perlite or like volcanic glass and the latter with the cellulosic fibers. It is capable of selectively sorbing oil from water and floating at the interface of the two liquids essentially indefinitely. The composition is principally an expanded volcanic glass compounded with the fibers positioned principally between the particles of the expanded mineral to form a network or skeleton of fibers. The fibrous component is treated with a water repellent sizing which renders the fibers hydrophobic (such as asphalt or pitch). The sizing also acts as a binder to hold the fiber and volcanic glass together. The product, cast on the water where oil spillage has occurred, floats, gradually sorbing the oil until the composition becomes essentially saturated, and is removed from the water by scooping up in suitable nets, rakes or other gathering devices. (Sinha-OEIS)
W79-09521

WATER PURIFICATION PROCESS,
Monsanto Co., St. Louis, MO. (Assignee).
M. F. Weishaar, and L. Ballard.
U.S. Patent No. 4,145,281, 6 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1014, March 20, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Industrial

water, Cooling water, Metals, Chromium, Zinc, Ion exchange, Anion exchange, Cation exchange, Regeneration, Product recovery.

The waste water from cooling tower blowdown is preferably first prefiltered to remove suspended material. The pH of the blowdown is then controlled for example within a range of 4.5 to 4.9, such as by addition of a mineral acid, e.g. hydrochloric acid or sulfuric acid. The blowdown is then passed through at least one weakly basic ion exchange resin bed to remove hexavalent chromium. Zinc and trivalent chromium are removed by then passing the blowdown through at least one weakly acidic cation exchange resin bed in the alkaline form, alakline being herein defined as sodium, calcium, potassium or magnesium. After continued usage the anion and cation resins may then be regenerated, and chromium and zinc compounds may be recovered during regeneration of each column and either used in other processes or stored for reuse as corrosion inhibitors for cooling towers. (Sinha-OEIS)
W79-09533

SKIMMER FOR OIL SPILLS,
C. E. Nagy, and J. F. Nagy.
U.S. Patent No. 4,145,290, 19 p, 30 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1017, March 20, 1979.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Water pollution treatment, Water quality control, Skimming, Equipment, Flow control, Skimmers, Funnels

A skimmer is provided for removing oil spilled on the surface of a body of water. The skimmer has a hull which is submersible in the water and a coupler on the nose of the hull for coupling the skimmer to a towing vehicle. A surge tank is located within the hull for receiving oil and water skimmed from the surface. A funnel positioned on top of the skimmer and extending through the hull has an inlet end positionable in the spilled oil and an outlet end extending into the surge tank. In one embodiment the inlet end comprises a pivotable head that is held level with the surface of the liquid by an attached float. A conveyor within the funnel controls the flow of oil and water into the surge tank. A sensor at the funnel inlet controls a hydraulic jack located between the funnel and the hull to position the inlet in the oil on the water's surface. A conduit is provided between the surge tank and a conduit coupler on the rear of the hull for use in pumping oil out of the surge tank and into an outside conduit. In a preferred embodiment, a pair of doors are hinged to the inlet end for either closing the funnel or for opening outward in a spread position to gather and channel the oil into the funnel. The doors can be joined to the ends of a floating fence so that oil confined within the fence is directed into the funnel as the skimmer and fence are pulled through the oil spill. (Sinha-OEIS)
W79-09538

SURFACE SKIMMER,
National Marine Service Inc., St. Louis, MO. (Assignee).
C. in't Veld.
U.S. Patent No. 4,145,292, 7 p, 10 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 3, p 1018, March 20, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Water quality control, Skimming, Flow control, Barriers, Equipment, *Oil booms, Skimmers.

An oil boom for sweeping and collecting oil from the surface of a body of water is constructed of a framework of structural members arranged in the form of a box beam, the framework supporting two parallel rows of floating barrier screen panels and being connected to end floats. Flow diverter vanes beneath the barrier screen panels cause a surface transport current to flow between the two rows of the panels towards a surface skimmer located adjacent one end of the boom when the boom is towed in a direction transversely of its length across a body of water to be swept. The forwardmost row of barrier screen panels sweeps floating oil on the water surface towards the skimmer, and the transport current carries oil that is caught in the underflow beneath the forwardmost row of panels towards the skimmer. Extension arms including floating vertical barrier screen panels are pivotally attached to the boom to extend the sweep area, the arms being foldable inwardly against the central boom structure for stowage of the boom. (Sinha-OEIS)
W79-09539

CELLULOSE ESTER ULTRA-FILTRATION MEMBRANES AND THEIR MANUFACTURE,
Canadian Patents and Development Ltd., Ottawa (Ontario). (Assignee).
For primary bibliographic entry see Field 3A.
W79-09540

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOL. II. BASIN PLAN APPENDIX,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5F.
W79-09332

PLAN OF STUDY FOR THE NORTHERN MIDWEST REGIONAL AQUIFER-SYSTEM ANALYSIS,
Geological Survey, Madison, WI. Water Resources Div.
W. L. Steinhilber, and H. L. Young.
Geological Survey Water-Resources Investigations 79-44 (open-file report), April 1979. 20 p, 2 fig, 7 ref.

Descriptors: *Aquifer management, *Project planning, *Regional analysis, *Hydrogeology, *Aquifer characteristics, Drawdown, Surface-groundwater relationships, Groundwater recharge, Groundwater availability, Water supply, Computer models, Geochemistry, Illinois, Indiana, Iowa, Minnesota, Missouri, Wisconsin, *Cambrian-Ordovician aquifer.

Sedimentary rocks of Cambrian and Ordovician age form a major aquifer system in most of Wisconsin and Iowa, northern Illinois, northwestern Indiana, southeastern Minnesota, and northern Missouri. Many metropolitan areas depend on the aquifer for all or part of their water supplies. Declines in potentiometric head have been large in the most heavily pumped areas, most notably Chicago, Milwaukee-Waukesha, Minneapolis-St. Paul, and Des Moines. A thorough understanding of the aquifer system is needed for sound management decisions. Thus, a 4-year study of the aquifer, beginning in October 1978, is included in the U.S. Geological Survey's program of Regional Aquifer-System Analysis. The study will evaluate the aquifer's water-supply potential, describe its water quality, and, through computer models of the ground-water flow system, provide the means to evaluate regional aquifer response to different patterns of ground-water development. This report describes the objectives, work plan, and organization of this study. (Woodard-USGS)
W79-09401

PLANNING WATER USE AND QUALITY CONTROL IN A RIVER BASIN,
Akademiya Nauk SSSR, Moscow.
V. G. Priazhinskaya, and I. L. Khranovich.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 239-247, June 1979. 3 ref.

Descriptors: *Planning, *Water quality, *Water demand, *Model studies, Mathematical models, Rivers, River basins, Water quality control, Pollutants, Path of pollutants, Water pollution, Water resources.

Quantity and quality control in a water resources system is considered to be an optimization problem on a graph with retarded controls, a non-convex biseparable objective function, and bilinear constraints which are equalities. Based on the branch and bound scheme, the solution of the problem with a given error was reduced to a finite series of convex estimating problems. (Sims-ISWS)
W79-09436

A PHANTOM DOCTRINE: THE ORIGINS AND EFFECTS OF JUST V. MARINETTE COUNTY (CONTROL OF LAKE SHORE EROSION THROUGH FILL PERMITS),
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 6E.
W79-09457

MULTILEVEL APPROACH TO URBAN STORM WATER SYSTEMS PLANNING,
Purdue Univ., Lafayette, IN.
S. Dendrou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 599, Price codes: A14 in paper copy, A01 in microfiche. PhD Dissertation. 1977. 283 p, 52 fig, 11 tab, 4 append. OWRT-B-083-IND(1).

Descriptors: *Urban drainage, *Urban land use, Drainage systems, Urban runoff, Storm drains, Storm runoff, Land use, Planning, City planning, *Urban growth, Urbanized watersheds, STORM, LANDUSE.

The study analyzes the relationship between urban growth and the storm drainage problem. A multilevel coordinating approach was used in a simulation-based optimization scheme that determines, at the planning level of details, the storm-water system best suited for a given trend of urban growth. The specific objectives were twofold: to select a land-use model producing independent urban growth alternatives and develop a model translating the alternatives into corresponding storm-drainage systems. The urban growth process was simulated by the use of the Model LANDUSE, a modified version of the 'Dynamic Land Use Allocation Model' of B. Walsh and S. Grava. The simulation model produced a number of independent plausible future scenarios of urban growth, the interfacing between urban growth model and storm drainage model being achieved by the notion of land-use categories. The urban hydrology model STORM was used at the subbasin level. For each urban growth scenario of LANDUSE, STORM produced the corresponding performance of a prespecified local storm drainage system. The requirements of the subbasins composing the urban agglomeration were then 'coordinated' to produce a globaly optimal storm-water system for a given urban growth pattern. (Wiersma--Purdue)
W79-09488

6B. Evaluation Process

ECONOMIC BENEFITS FROM INSTREAM FLOW IN A COLORADO MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Economics.
J. T. Daubert, R. A. Young, and S. L. Gray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 490, Price codes: A08 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No. 91, June 1979. 149 p, 6 fig, 24 tab, 69 ref, 4 append. OWRT A-035-COLO(1) and A-040-CO(1).

Descriptors: *Instream flow, Evaluation, *Recreation, Trout, Regression analysis, Water allocation, Cache la Poudre River(Colorado).

Water flowing in streams has value for various types of recreationists. Increasing instream flows from low levels may enhance the recreational experience for fishermen, white water enthusiasts and

shoreline recreationists. Increasing instream flows in arid and semi-arid conditions may be in conflict with established withdrawal uses for irrigation, industries and households. Instream flows have a public or collective good character, such that market prices are not observable. Estimating marginal values for instream flow which are commensurate with those for withdrawal uses presents well-known difficulties. Following recently developed techniques for estimating the value of public goods, an iterative bidding game was administered in 1978 to a sample of recreationists using a Colorado mountain stream, to determine their willingness to pay for alternative rates of flow. Regression techniques were applied and the results were used to estimate the marginal value of instream flows for each month of the recreation season. The statistical reliability of the estimates was more than adequate, indicating the technique is suitable for aiding in instream flow management decisions.
W79-09416

WETLAND VALUES: CONCEPTS AND METHODS FOR WETLANDS EVALUATION,
Institute for Water Resources (Army), Fort Belvoir, VA.
R. T. Reppert, W. Sigleo, E. Stakhiv, L. Messman, and C. Meyers.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A069 088, Price codes: A06 in paper copy, A01 in microfiche. Research Report No. 79-R1, February 1979. Supercedes Wetland Values-Interim Assessment and Evaluation Methodology. 116 p, 5 fig, 11 tab, 146 ref.

Descriptors: *Wetlands, *Analysis, *Evaluation, *Classification, Biological communities, Food chains, Ecosystems, Habitats, Sanctuaries, Shore protection, Groundwater recharge, Water quality, Hydrologic systems, Flood protection, Environmental effects, Coastal marshes.

Guidelines for the identification and evaluation of the physical, biological, and human use characteristics of wetlands are presented. These guidelines are primarily intended to serve as an operational guide for wetland studies made in conjunction with Corps of Engineers civil works activities and regulatory functions. Wetlands are defined and described. Basic functions and values covered are: natural biological functions including food chain productivity and habitat, usage as sanctuaries, shoreline protection, groundwater recharge, storage for flood and stream water, water quality improvement, hydrologic support, and cultural values. Specific criteria for determining the efficiency with which these functions are performed are identified. Wetland evaluation methods discussed include a non-quantitative method in which individual wetland areas are evaluated based on the deductive analysis of their individual functional characteristics, and a semi-quantitative method in which the relative values of two or more site alternatives are established through the mathematical rating summation of their functional relationships. An analysis of a hypothetical wetland is included. (Seigler-IPA)
W79-09433

FUTURE THINKING: FAD OR NECESSITY,
Institute for Water Resources (Army), Fort Belvoir, VA.
J. D. Priscoli.
Water Spectrum, Vol. 11, No. 2, p 9-15. Spring 1979. 5 fig.

Descriptors: *Water resources, *Water resources development, *Water supply, *Planning, Forecasting, Droughts, Political aspects, Administration, Floods, Federal government, Social aspects, Water supply.

The changing attitudes, problems and positions of water resources planners are discussed. The standard view of planning, that it is limited to factual consideration of means toward ends which are established outside of the planning process, is almost useless to field planners. Planning success is no longer measured by the traditional yardstick of new structures, but by the basic quality and availability of our water. Two views of water resources planning, scientific-administration and political-legislation, are considered. The current trend is away from making planners into politicians and toward making politicians, planners. The emerging role of water resources planners requires that they use their expertise to generate new options to meet changing social values rather than to rely on comfortable, timeworn solutions. Planners must also be managers which entails anticipating and mitigating conflicts, involving people, and facilitating concensus along the way. Failure to hone these skills as managers will increase planning and operating costs, decrease responsiveness to public needs, and weaken the nation. Thinking about the future is creating, designing, and expanding options. It is a management strategy as well as a 'scientific' analysis. (Seigler-IPA)
W79-09465

THE MOMENCE WETLANDS OF THE KANKAKEE RIVER IN ILLINOIS -- AN ASSESSMENT OF THEIR VALUE, A DESCRIPTIVE AND ECONOMIC APPROACH TO THE APPRAISAL OF NATURAL ECOSYSTEM FUNCTION,
W. J. Mitsch, M. D. Hutchinson, and G. A. Paulson.
Illinois Institute of Natural Resources, Chicago, Division of Environmental Management. Doc. No. 79/17, May 1979. 61 p, 13 fig, 5 tab, 53 ref, 2 append. 20.114.

Descriptors: *Wetlands, *Kankakee River(Illinois), *Land appraisals, Evaluation, Water quality, Wildlife management, Fisheries, Sediment control, Flood control, Groundwater recharge, Flood plains, Drought tolerance, Preservation, Forests.

Arguments for the preservation of the Momence Wetlands based on their actual and potential public service functions are presented. The area is a six-mile section of floodplain forest, marshes, sloughs, and upland forest from the Illinois - Indiana state line to Momence, Illinois. Although much of the area is privately owned, there is little evidence of man's activity and most of the area remains as it was in presettlement times. In spring, the river exceeds its bank, often for several weeks, submerging the bases of the floodplain trees. Valuable functions of the wetlands include: fish and wildlife protection, flood control, drought prevention, water quality enhancement, and sedimentation control. The wetlands also are of historic value as a significant remnant of our natural heritage. Two general approaches were used to determine the economic value of the natural areas of the Momence Wetlands. One approach, utilizing estimations of the cost of replacing ecosystem function by technology, placed a value of $494 per acre per year on the 1,899 acres of wetlands. The second approach, using the ecosystem energy flow as a collective measure of ecosystem function, placed a value of $289 per acre per year on the land. Although these estimates differ and are approximate, they both indicate that the wetlands are valuable in their natural state and should receive special preservation protection. (Seigler-IPA)
W79-09473

DOING SOCIAL EFFECTS ASSESSMENT: TWO CASES FROM A CORPS FIELD DISTRICT,
Army Engineer District, Portland, OR.
R. Love.
IWR Research Report 78-R4, November 1978. Final Report submitted to the U.S. Army Engineer Institute for Water Resources. 42 p, 3 fig, 3 tab, 8 ref, 2 append.

Descriptors: *Social effects assessment, *Social impact, Oregon, Applegate Dam, Days Creek Dam, Reservoirs, Relocation, Water quality, Recreation, Irrigation, Flood control, Land use, Economic impact, Condemnation value.

The methods used to conduct social effects assessments for two proposed Corps projects in southwest Oregon, Applegate and Days Creek dams, are described and discussed. Management and technical considerations involved in the assessments are described in a step-by-step historical presentation. The study is intended to complement the 'how to do social effects analysis' thrust of preceeding manuals. A summary of social effects include: (1) social settings, (2) effects of displacement on relocatees, (3) effects stemming from displacement of social institutions, (4) effects from reservoir recreation, (5) effects from irrigation, (6) effects from flood control, and (6) effects from water quality and low flow augmentation. Social profiles were developed on the people who would be affected by various aspects of the proposed reservoirs, especially those living relatively close to the projects. The interrelationship between social system, land use, and population factors served as a general conceptual scheme for the assessments. A sample of the questionnaire used when interviewing local people is included. (Seigler-IPA)
W79-09481

IMPACT OF DAM AND LAKE CONSTRUCTION ON RURAL ECONOMIES,
Corps of Engineers, Omaha, NE. Missouri River Div. Lab.
D. Gjesdahl, and W. Drake.
IWR Research Report No. 79-R4. Submitted to the U.S. Army Engineer Institute for Water Resources, April 1979. 29 p, 4 fig, 11 tab, 15 ref.

Descriptors: *Social impact, *Land use, *Economic impact, *Dams, *Lakes, Recreation, Population, Employment, Taxes, Planning, Land acquisition, Water resources development, Social aspects, Rural areas, Missouri, Kansas.

The economic impacts of five multipurpose dam and lake projects located in rural areas of Kansas and Missouri were assessed. Elements of land use, population and employment, and government and taxes were evaluated as indicators. The four projects in Kansas are Perry, Ponona, Tuttle Creek, and Milford. The fifth project, Pomme de Terre, is located in southwestern Missouri. Each of these projects has potential for considerable recreation development and each lake is between 30 and 150 miles of the Kansas City metropolitan area. The assessment time frame focused on three distinct phases of project land acquisition and development. There is little evidence that government land acquisition for the projects had a significant adverse effect on the economics of the project counties. Those people immediately touched by the acquisition of their land, however, undoubtly suffered acute economic disruption and probably faced considerable social adjustment. The projects introduced a new industry, recreation, to the counties. Large numbers of people have been attracted to the lakes. However, it is difficult to detect a significant economic contribution by the recreation industry to the local economy. Also, the lakes have stimulated relatively little capital investment. It is probable that the economic benefits are distributed throughout a large region and reach, especially into the metropolitan cities where recreation facility users live, work, and shop. (Seigler-IPA)
W79-09483

CHIEF JOSEPH DAM COLUMBIA RIVER, WASHINGTON: COMMUNITY IMPACT REPORT UPDATE III CONDITIONS AT PEAK IMPACT,
Army Engineer District, Seattle, WA. Seattle District.
A. A. Harnisch.
IWR Research Report No. 78-R2. Submitted to the Institute for Water Resources, December 1978. 68 p, 14 fig, 20 tab, 1 append.

Descriptors: *Chief Joseph Dam, *Social impact, *Economic impact, *Water resources development, Planning, Construction, Employment, Population, Public health, Columbia River, Schools, Housing, Recreation, Land use, Service impact, Water resources planning.

Peak construction social impacts at Chief Joseph Dam, Washington were compared to those projected in pre-construction phases. The dam is located on the Columbia River in north-central Washington near the small communities of Bridgeport and Brewster. The area is predominantly agri-

cultural, with scattered small rural towns. Agriculture is an important component of the economy, with irrigated fruit crops, beef cattle, and wheat as primary products. Areas of social and economic effects discussed include: population growth, housing, schools, health care facilities, traffic, noise, police protection, fire protection, utilities, esthetic values, civic organizations, and community growth. A profile was developed of a 'typical' construction worker that included: residency, prior employment, occupation, age, marital status, family size, and school age children. Results show an influx of about 1,000 new residents, the equivalent of a 50 percent population increase during a 2-year period. Quality and availability of housing were insufficient. Local schools received the major impact, and enrollments rapidly exceeded capacity. Sewer and water utilities also operated at or in excess of capacity. Aside from the crowded housing and schools, the local communities exhibited little physical change from preimpact conditions. Indications are that the towns will rapidly revert to preimpact population levels as dam construction is completed. (Seigler-IPA)
W79-09484

METHODOLOGIES FOR VALUATION OF AGRICULTURAL CROP YIELD CHANGES--A REVIEW,
Eureka Labs., Inc., Sacramento, CA.
S. Leung, W. Reed, S. Cauchois, and R. Howitt.
Publication No. EPA-600/5-78-018, August, 1978. 167 p, 5 fig, 3 tab, 433 ref.

Descriptors: *Crop production, *Economic impact, Economic prediction, Yield equations, *Model studies, Methodology, Reviews, Pollutants, Air pollution, Agriculture.

This research effort was initiated with the objective to complete a review and evaluation of the methodological and analytical techniques used to assess and quantify the economic impact of changes in agricultural crop yields. The review focused on two major areas: (1) physical effects of man-made and natural factors on agricultural crop yield, and (2) methodologies and models used to evaluate and quantify the economic impacts of crop yield changes on the farm, the agricultural industry and finally the consumers. The major natural environmental factors included in this report are climate and weather, soil and biological conditions. Air pollution was the main consideration under the man-made factors. Three alternative models were identified for the evaluation of the cost to an individual farm due to changes in crop yield. These models are (a) mathematical optimization model, (b) simulation model, and (c) econometric model. Also outlined were the regional input-output model and the regional spatial programming model as two feasible approaches in evaluating the secondary economic impacts. Finally, the market supply and demand theories were identified as relevant concepts in analyzing the overall impacts on consumers due to crop yield changes. (Skogerboe-Colorado State)
W79-09489

6D. Water Demand

PLANNING WATER USE AND QUALITY CONTROL IN A RIVER BASIN,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 6A.
W79-09436

6E. Water Law and Institutions

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOL. II. BASIN PLAN APPENDIX,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5F.
W79-09332

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME IV. INSTITUTIONAL ARRANGEMENTS,
Texas Governor's Planning Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 847, Price codes: A04 in paper copy, A01 in microfiche. U.S. Army Corps of Engineers, Fort Worth District, September 1973, 55 p, 3 append.

Descriptors: *Water quality, *Water resources, *Waste water treatment, *Planning, *Colorado River Basin(TX), *Institutions, *Texas, Sewage districts, Water districts, Water management, Administrative agencies, Waste water facilities, Institutional constraints, Water quality management(Applied), State planning, Regional planning.

The objective of this study is the development of the most cost-effective strategy to meet stream water criteria for the 50-year planning period 1970-2020. The primary purpose of this phase was the development of institutional arrangements for the design, construction operation and maintenance of recommended system(s). Base data were gathered by questionnaire, interviews, telephone calls, and research. Existing institutions involved in water pollution control are described. Municipalities are more involved in water pollution abatement than any other institution. There are approximately 79 treatment plants in the Basin, generally owned by the municipality in which they are located. Location, design load, and current and projected populations for the regional planning area of each plant are presented. Five alternative institutional arrangements which could implement a wastewater management plan are described. Under existing Texas law, the Texas Water Quality Board (TWQB) has the overall authority in the implementation of institutional arrangements. The favorable and unfavorable impacts of each of the five alternative implementation plans are presented. Institutional arrangements are discussed and evaluated. Alternative 1 is recommended as the most favorable for implementation of this study--the TWQB coordinating implementation functions directly with municipalities and other public entities. (See also W79-09331) (Coan-NC)
W79-09334

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME V. UPPER BASIN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09335

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME VI. CENTRAL BASIN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09336

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME VII. LOWER BASIN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5D.
W79-09337

THE TASK OF RELATING THE LOCAL GOVERNMENT COMPREHENSIVE PLAN OF PALM BAY TO THE OTHER PLANS OF THE STATE,
G. S. Fortin.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611. $0.80. 1978, 20 p, 45 ref.

Descriptors: *Local governments, *Florida, *Land management, *Comprehensive planning, Land development, Water storage, Water management, Water districts, Water pollution control, Water zoning, Watershed management.

The intergovernmental consistency of the Local Government Comprehensive Plan for Palm Bay, Florida as related to the Local Government Comprehensive Plans of the surrounding local governments is explored. The focus is on the problems inherent in the making of a plan, due to both the individual problems of Palm Bay, and those inherent in the Local Government Comprehensive Planning Act (LGCPA). Discussed are the Melbourne Tillman Drainage District Revised Plan of Reclamation, the Brevard County Land Use Plan, Phase I Plan of the St. Johns River Water Management District, the Coastal Zone Management Plan proposal, and the Florida State Comprehensive Plan submitted February 9, 1978. A Comprehensive plan is mandated by the Local Government Comprehensive Planning Act (LGPCA). The legislative intent was that there be cooperation and coordination of planning and development through comprehensive planning. Some of the problems encountered in attempting to meet this goal are discussed. (Coffey-Florida)
W79-09442

CONSTRUCTION AND APPLICATION OF GEOTHERMAL STEAM ACT OF 1970, PERTAINING TO LEASES OF GOVERNMENT LANDS FOR DEVELOPMENT OF GEOTHERMAL STEAM RESOURCES,
E. R. Alston.
40 A.L.R. Fed. 814-20 (1978).

Descriptors: *Steam, *Resources development, *Public lands, *Leases, Federal government, Federal jurisdiction, Energy budget, Electric generators, Electricity, Water policy, Water law.

The federal cases are collected and analyzed wherein the courts have construed or applied the provisions of the 1970 Geothermal Steam Act (Act). The Act provides for the development, production, and utilization of geothermal steam and associated resources on public lands as a commercially viable energy source. Geothermal energy is defined as the earth's heat energy produced by the intrusion of magma or molten rock into the earth's crust, heating porous rocks containing water to temperatures as high as 500 degrees F. This superheated water rises to the earth's surface through natural vents as steam, which may be used to generate electricity. In recommending passage of the Act, the Committee on Interior and Insular Affairs stated that geothermal energy is a potentially invaluable untapped natural resource, and that geothermal resources promise to be a relatively pollution-free energy source. The Act's provisions regarding the terms and conditions of geothermal leases, not construed by reported cases, are also discussed. (Coffey-Florida)
W79-09443

CARTER'S WATER POLICY TO GET CONGRESSIONAL TEST,
A. Pelham.
Congressional Quarterly Weekly Report, Vol. 36, No. 23, p 1491-94, June 10, 1978.

Descriptors: *Water policy, *Federal government, *Political constraints, *Political aspects, Federal budget, Dams, Water conservation, State governments, Economic justification, Groundwater, Water management, Water law.

In June, 1978 President Carter announced a national water policy designed to tighten Administrative control over federal spending for expensive dams and other water projects. An analysis of Carter's policy proposals is presented. The administration's proposals placed new emphasis on water conservation as a national goal and more state participation in the planning and funding of water projects. Future authorizations for projects would have to meet tougher criteria for enhancing conservation providing national economic benefits and protecting the environment. A new review panel would provide an independent uniform analysis of all federal water projects. This report would be available to the public. Carter did not seek legislation to raise the interest rate used to compute project benefits and costs despite complaints that the rate is artificially low and tends to favor the construction of projects. Little incentive is provided for better groundwater management by western states. (Coffey-Florida)

W79-09444

HOUSE VOTES AMENDED CONTINENTAL SHELF BILL,
A. Pelham.
Congressional Quarterly Weekly Report, Vol. 36, No. 5, p 251-54, February 4, 1978.

Descriptors: *Oil pollution, *Continental shelf, *Political aspects, *Federal government, Political constraints, Oil, Oil industry, Oil spills, Offshore platforms, Leases, Water policy.

After accepting a hodgepole of amendments that calmed many critics, the United States House of Representatives voted to amend the law that since 1953 has governed oil and gas development on the Outer Continental Shelf (OCS). A detailed analysis of the political aspects of obtaining legislation on drilling for oil on the OCS is presented. The alternative bidding systems instituted by Congress and how the compromise was finally reached are explained. The House committee was bill authorized grants of $125 million annually through fiscal 1984 to the coastal states to handle problems with OCS related activity. Other amendments adopted by the House included: (1) deleting the provision which expanded the authority of the Occupational Health and Safet Administration over OCS activities; (2) increasing the maximum payment from the Fisherman's Gear Compensation Fund; (3) authorizing $5 million in annual grants to states for costs associated with their increased role in federal decisions on offshore leasing; and (4) changing the position of a lease-holder seeking compensation for a cancelled lease. Also reported are the suggested amendments that failed. (Coffey-Florida)
W79-09445

CONGRESS OVERHAULS CONTINENTAL SHELF LAWS,
A. Pelham.
Congressional Quarterly Weekly Report, Vol. 36, No. 34, p 2253-55, August 26, 1978.

Descriptors: *Continental shelf, *Offshore platforms, *Federal government, *Oil pollution, Oil, Oil industry, Environmental control, Leases, State government, Oil spills, Oil reservoirs, Water policy.

The first overhaul of offshore oil and gas leasing laws in 25 years is expected to be signed by President Carter in early September, 1978. The long-sought changes were given final approval by Congress after almost four years of debate. Although Congress had faced bitter opposition, the latest compromise was generally accepted by most major oil companies, environmentalists and the Carter administration. Many of the modifications and amendments to the 1953 Outer Continental Shelf Lands Act are discussed: (1) development of a Comprehensive five-year program for Outer Continental Shelf leasing; (2) solicitation of recommendations regarding the leasing program from governors of effected states; (3) an environmental study of each general area proposed for leasing; (4) review study of safety regulations; (5) permission to effected persons to challenge any Act violation in court; (6) setting of civil penalties of up to $10,000 per day for failure to comply with the Act; (7) submission of a required development and production plan for all future leases; and (8) a review of the development plants by the Secretary of the Interior. (Coffey-Florida)
W79-09446

WETLANDS AND FLOODPLAIN PROTECTION,
G. McGregor, and A. Dawson.
Massachusetts Law Review, Vol. 64, No. 2, p 73-80, April 1979.

Descriptors: *Wetlands, *Flood plains, *Massachusetts, *Flood protection, Federal government, State government, Local governments, Water policy, Water pollution, Flood control, Navigation, Groundwater.

Many federal, state, and local bylaws, regulations and statutes regulate development in water bodies, waterways, associated wetlands and areas prone to flooding. Principal interests protected are flood control, water supply, groundwater, navigation, the natural food chain, prevention of storm drainage and pollution, and protection of fish and shellfish. These controls effect developers, landowners, financial institutions, contractors, municipalities, abutters, agencies and public interest groups. The attorney representing such clients is commonly confronted with two problems: (1) how to know when a wetland issue arises and what regulatory controls are likely to apply, and (2) how to predict accurately the jurisdiction, the likely agency concerns and avoid procedural stumbling blocks. The federal, state and local wetland and floodplain protection programs of which the attorney should be aware are surveyed. The ways in which the practioner will confront legal provisions affecting clients and the ways to foster an understanding of the basic agency procedures and the public interests involved are illustrated. (Coffey-Florida)
W79-09447

CARTER'S WATER POLICY REFORMS - TRYING NOT TO MAKE WAVES,
D. Kirschten.
National Journal, Vol. 11, No.10, p 394-97, March 10, 1979.

Descriptors: *Water policy, *Federal project policy, *US Water Resources Council, *Federal budget, Federal government, Political aspects, Political constraints, Financing, Financial feasibility, Administration, Administrative decisions.

After a bruising battle over water projects in the last Congressional Session, the Carter Administration has decided to push its water policy reforms more cautiously. A detailed analysis of the many reforms suggested by the Carter administration and the political constraints those reforms encountered are presented. President Carter now appears to be charting a safer course through the 96th Congress. His fiscal 1980 budget proposals have drawn fire from both reformers and defenders of the status quo - a sign that his proposals are somewhere near middle ground. The Administration is stressing the importance of accepting some past congressional decisions not to the Administration's liking, rather than resurrecting those battles already lost. The Administration has three immediate objectives in this Congressional session: (1) a defense of their 1980 water projects budget; (2) passage of a state-federal cost-sharing bill designed to give the states some leverage in the selection of projects; and (3) a quick infusion of funds for the Water Resources Council that will set new project standards, review construction decisions and administer grant programs to promote state water conservation and planning efforts. (Coffey-Florida)
W79-09448

CUTTING FUTURE LOSSES: DROUGHT SPURS FEDERAL WATER POLICY REVIEW,
J. Wagner.
Congressional Quarterly Weekly Report, Vol. 35, No. 41, p 2139-42, October 8, 1977.

Descriptors: *Droughts, *Federal project policy, *Water supply development, Water conservation, Water demand, Water levels, Water shortage, Water requirements, Water supply, Aqueducts, Water policy.

Although the drought of 1977 threatened essential food crops, forced water conservation measures and set off federal spending of approximately $2-billion, it has not been quite the disaster predicted. Several federal agencies provided emergency grants and loans to ease the drought's effects. A nation-wide disaster may have been averted, but the drought has focused attention on programs that bring relief but no protection. Federal officials are emphasizing planning for droughts and wiser land use in dry areas. Much of the federal effort in the past has gone into constructing gigantic water projects which have fostered the ideas that water is a boundless resource and that enough dams and aqueducts will prevent drought. In 1977, those ideas were disproven. The Administration's emergency program and all the additional funds now going to drought relief are short-term measures. They can mitigate some effects of drought but they do not get to the basic issue of water policy reform. The Carter administration has begun a review of federal water policy that is expected to propose new criteria for building and managing reclamation projects. (Coffey-Florida)
W79-09449

WATER POLLUTION COMPROMISE CLEARED,
A. Pelham.
Congressional Quarterly Weekly Report, Vol. 35, No. 52, p 2666-75, December 24, 1977.

Descriptors: *Water pollution, *Federal water pollution control act, *Political aspects, *Water pollution treatment, Economic feasibility, Economic impact, Environmental effects, Industries, Administrative agencies, Water policy, Political constraints, Economic justification.

The amendments in the 1977 Clean Water Act (CWA) kept intact the basic principles of the strong 1972 Federal Water Pollution Control Act (FWPCA) though some clean up delays were allowed on economic grounds. The changes made by the CWA were touted as only mid-course corrections, when Congress began tinkering with the FWPCA. Industry had hoped for a major rewrite. Environmentalists had feared a damaging postponement of the FWPCA's goals. Ultimately, the final compromises left no clear victor. Industry spokemen hailed the bill as a step towards reasonableness in pollution control but admitted some disappointments. Environmental groups were split. Some joined the federal Environmental Protection Agency (EPA) officials in praising the conferees. Others insisted the legislation was a step backwards. The amendments provide the EPA administrator with new flexibility, make control of toxic chemicals top priority, and provide major funding for the nation's sewage treatment construction program. An indepth analysis of these amendments and background information are provided. (Coffey-Florida)
W79-09450

CHATTAHOOCHEE RIVER NATIONAL RECREATION AREA - GEORGIA - ESTABLISHMENT.
Public Law 95-344, secs 101 thru 306, 92 Stat. 474 (1978).

Descriptors: *Georgia, *Chattachoochee River, *National recreation areas, *Recreation facilities, Federal government, Recreation, Protection, Preservation, Public benefits, Public lands, Public access, Rivers.

The Congress has found the natural, scenic, recreation, historic, and other values of a forty-eight mile segment of the Chattahoochee River and certain adjoining lands from Buford Dam downstream to Peachtree Creek are of special national significance. Such values should be preserved and protected from development and uses which would substantially impair or destroy them. To assure such preservation and protection the Chattahoochee River National Recreation Area was established. The recreation area shall consist of the river and its bed plus lands, waters, and interests within the boundary depicted on the Chattahoochee River National Recreation Area map, numbered CHAT-20,000, on file in the office of the National Park Service, Department of the Interior. The Secretary of the Interior is authorized to make minor revisions in the recreation area boundary to facilitate access to the recreation area or to delete lands which would be of little or no benefit to the area. Lands of no benefit are those on which valuable improvements have been completely constructed prior to this Act's enactment. (Coffey-Florida)
W79-09451

COAL MINING POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, DC.

Federal Register, Vol. 44, No. 9, p 2586-92, January 12, 1979.

Descriptors: *Coal mines, *Coal mine wastes, *Navigable waters, Federal water pollution control act, Federal government, Water law, Water policy, Pollution abatement, Political constraints, Regulations.

On September 19, 1977, the Environmental Protection Agency (EPA) proposed regulations setting forth limitations on the pollutant discharge into navigable waters from new source coal mines and coal preparation plants, as required by the Federal Water Pollution Control Act. The rules here promulgated establish final performance standards for new sources in the coal mining point source category. Changes and clarifications in response to comments received on the proposed regulations are included. These performance standards will be incorporated in National Pollutant Discharge Elimination Systems permits issued by EPA or by states with approved programs. The regulations incorporate several adjustments to the proposed standards of performance. These changes reflect EPA's consideration of the substantial number of comments received from industrial and environmental groups. The comments are addressed in detail in Appendix A to the preamble. The effective date is February 19, 1979. (Coffey-Florida)
W79-09452

OUTER CONTINENTAL SHELF LANDS ACT AMENDMENTS OF 1978.
Public Law 95-372 (S.9), secs 101 thru 608, 92 Stat. 629 (1978).

Descriptors: *Continental shelf, *Oil fields, *Resources development, Natural gas, Pollution abatement, Oil wastes, Oil pollution, Oil, Oil wells, Oil reservoirs, Federal government.

The purposes of this Act are to: (1) establish policies and procedures for managing the oil and natural gas resources of the Outer Continental Shelf (Shelf); (2) preserve, protect, and develop oil and natural gas resources in the Shelf consistent with the nation's energy needs while protecting the human, marine, and coastal environments; (3) ensure the public a fair return on the Shelf's resources while preserving free enterprise competition; (4) encourage development of new and improved technology to eliminate or minimize risk of damage to the environment; (5) provide assistance to states and local governments to deal with the impact of Shelf oil and gas activities; (6) assure participation of state and local governments in planning and policy decisions relating to Shelf resource management; (7) minimize or eliminate conflicts between oil and gas production and the recovery of other resources, such as fish and shellfish; (8) establish an oilspill liability fund; and (9) establish a fishermen's contingency fund to pay for damages to commercial fishing vessels and gear due to Shelf activities. (Coffey-Florida)
W79-09453

OCEAN THERMAL ENERGY CONVERSION (OTEC) DEVELOPMENT UNDER U.S. AND INTERNATIONAL LAW AND INSTITUTIONS,
Denver Univ., CO.
V. P. Nanda.
Denver Journal of International Law and Policy, Vol. 8, No. 1, p 239-88, Winter, 1979.

Descriptors: *Thermal water, *Thermal powerplants, *Energy conversion, Energy, Energy transfer, Law of the sea, Conferences, Jurisdiction, Regulation, Environmental effects, Oceans.

Ocean thermal energy conversion (OTEC) is a viable alternative in the near future. Although economic and technological issues have not been settled, the legal aspects must be considered. Jurisdictional, regulatory, and environmental issues are addressed. Emphasis is placed on the potential impact of the Third United Nations Conference on the Law of the Sea. On the jurisdictional issues, the United States should seek freedom in OTEC siting and development. From a domestic perspective, there are valid reasons for state or federal control of OTEC facilities. Development of regulatory schemes should provide certainty for prospective investors. An inflexible or cumbersome regulatory scheme must be avoided. Potential environmental impacts from OTEC facilities include those from construction and operation of such facilities, cables and transmission lines, and onshore services and support facilities. Domestic legislation relevant to OTEC is discussed. These include the Outer Continental Shelf Lands Act and the 1969 National Environmental Policy Act. Comprehensive ocean management legislation is needed for the United States. Internationally, a convention which mandates environmental impact assessments of any state's major projects should be considered. (Walker-Florida)
W79-09454

THE POLITICS OF MANGANESE NODULES: INTERNATIONAL CONSIDERATION AND DOMESTIC LEGISLATION,
Committee on Merchant Marine and Fisheries (U. S. House).
J. Murphy.
San Diego Law Review, Vol. 16, No. 3, p 531-55, April 1979.

Descriptors: *Political aspects, *Manganese, *International law, *United Nations, Legislation, Political constraints, Legal review, Mining, Law of the sea, Economic justification, Economic feasibility.

The legal regime governing the recovery of deep seabed minerals may be the most difficult issue now confronting the United Nations Conference on the Law of the Sea. Congressman John M. Murphy discusses unilateral legislation. Such legislation would be fully consonant with prevailing international law and would spur on the negotiations of the Conference. The various economic, legal, and political considerations involved in the recovery of deep seabed minerals and the problems associated with the United Nations Conference on the Law of the Sea are outlined. The Deep Seabed Mining bill is analyzed in the context of the international legal system and the Law of the Sea Conference. The United States should enact the bill so that exploration and commercial recovery may proceed. Legislation of the type Congressman Murphy proposes will have a positive economic impact on the entire world, will encourage the technological advances, and will persuade the negotiating states to begin good faith bargaining. (Coffey-Florida)
W79-09455

THE OUTER CONTINENTAL SHELF: BRIDGING THE INFORMATION GAP THROUGH REGULATION,
S. A. Shafer.
Arizona State Law Journal, Vol. 1978, No. 4, p 617-40, 1978.

Descriptors: *Continental shelf, *Oil wells, *Leases, Political aspects, Resources development, Environment, Environmental effects, Energy, Geographical regions, Decision making, Legislation.

Oil and gas reserves beneath the waters of the Outer Continental Shelf (OCS) are important for meeting the current and future energy needs of the United States. Two types of information are needed for rational decision-making concerning OCS development. First, exploratory information is needed to assess the extent of OCS oil and gas reserves. Second, environmental information is needed to determine the potential harmful effects of OCS development. The Outer Continental Shelf Lands Act (OCLA) gave the Secretary of Interior the authority to lease lands on the OCS for oil, gas, and mineral production. The 1978 Amendments to the OCSLA provide that the OCS leasing programs are to be guided by four primary policy goals: (1) rapid development of OCS oil and gas reserves; (2) protection of the environment; (3) realization of a fair return to the government; and (4) assurance of free competition among firms bidding for OCS leases. The OCSLA and other federal laws seek to ensure that OCS leasing decisions are not made without sufficient knowledge of the potential benefits and risks. (Fortin-Florida)
W79-09456

A PHANTOM DOCTRINE: THE ORIGINS AND EFFECTS OF JUST V. MARINETTE COUNTY (CONTROL OF LAKE SHORE EROSION THROUGH FILL PERMITS),
Minnesota Univ., Minneapolis.
D. P. Bryden.
American Bar Foundation Research Journal, 1978 Volume, No. 3, p 397-513, Summer, 1978.

Descriptors: *Zoning, *Land use, *Marsh management, Marshes, Planning, Local governments, Land management, Landfills, Environmental control, Regulation, Permits.

In testing the constitutional limits of the police power in zoning regulation, the main issue is how severely the government may reduce the value of land without compensating the owner. Recently, state and local governments have sought to preserve the landscape by novel and sometimes stringent land use controls. Some scholars have suggested abandoning the 'diminution-of-value' test for determining a regulation's constitutionality. In Just v. Marinette County, the Wisconsin Supreme Court declared that shoreland marsh development may be forbidden irrespective of the economic impact on the landowner. Such decisions create the impression that property owners are being sacrificed for the sake of environmental quality. But a study of Just's origins and effects reveals that in Wisconsin and Minnesota this impression of regulatory zeal is inaccurate. The main concern of the counties studied was not to preserve marshes but rather to attach erosion-control conditions to fill permits. It appears that ideology and politics, not constitutional law, are the major factors limiting the severity of conservancy zoning. (Fortin-Florida)
W79-09457

EXTENDED FISHERY JURISDICTION IN CANADA AND THE UNITED STATES,
West Coast Oil Ports Inquiry, Vancouver (British Columbia).
R. Snow.
Ocean Development and International Law, Vol. 5, No. 2/3, p 291-344, 1978.

Descriptors: *Canada, *United States, *Jurisdiction, *Fish management, Fisheries, Fish conservation, Fish harvest, Water law, Fish populations, Food abundance, Recreation.

The two hundred mile fishery zone presents opportunities for coastal states to create new institutions or pursue new management strategies. The strategies followed by the United States and by Canada in the initial stages of their extended jurisdiction management programs are discussed in sociolegal and historical contexts. The domestic legal authority for the management programs is reviewed. Planning procedures and available sanctions are outlined. The control of domestic and foreign fishing is discussed. There should be greater participation in the development of fishery management plans. A possible system for implementation is suggested. The American management system is open, decentralized, and highly structured. In contrast, the Canadian system is closed, relatively centralized, and very flexible. Both approaches are considered extreme. There is no evidence of the development of new procedures for management decision making. (Coffey-Florida)
W79-09458

THE CLEAN WATER ACT OF 1977: EXPANDED COMPETENCE OVER VESSEL-SOURCE POLLUTION,
Virginia Univ., Charlottesville.
R. R. Pixa.
Virginia Journal of International Law, Vol. 18, No. 2, p 289-317, 1978.

Descriptors: *Federal water pollution control act, *Water pollution control, *Water pollution sources, *Oceans, Water quality act, Pollution abatement, Legislation, Environmental controls, Conservation, Juridiction, Water law.

The law governing vessel-source pollution is an accretion of provisions in Title 33 of the United States Code, built upon the Federal Water Pollution Control Act, the 1970 Water Quality Improvement Act, and the 1972 Federal Water Pollution Control Act. The Clean Water Act raises four principal issues concerning vessel-source pollution: (1) the size of the area over which competence is claimed; (2) the duties of vessels within that area; (3) the liability to be imposed upon those vessels; and (4) the enforcement scheme to be employed. The pollution control scheme in force is limited over foreign-flag vessels, not otherwise under United States jurisdiction, navigating within a loosely defined area from 12 to at least 200 miles seaward from U.S. coasts. The scheme includes penalties for discharges of harmful quantities of nonremovable hazardous substances and for government costs. It also attempts to impose a duty to give notice of illegal discharges but has no enforcement provisions. Because the Clean Water Act has not yet been enforced, it is a devise of undetermined power. (Fortin-Florida)
W79-09459

THE COMMON HERITAGE OF MANKIND: HAS THE GENERAL ASSEMBLY CREATED A LAW TO GOVERN SEABED MINING,
P. L. Saffo.
Tulane Law Review, Vol. 53, No. 2, p 492-520, February, 1979.

Descriptors: *Law of the sea, *United Nations, *Resources development, *International law, International waters, Deep water, Mining, Mineral industry, Conferences, Jurisdiction, Resources.

Committee I at the United Nations Conference on the Law of the Sea is deadlocked on the procedure which should be employed to control the mining of the deep seabed. The less developed nations desire an International Seabed Authority to gather technology and establish a monopoly, so that multinational corporations could be phased out of the mining process. The developed nations want minimum administrative encumbrances. Should the Conference fail to establish guidelines, the mining will proceed under customary international law. Three potential approaches are proposed that a nation can adopt to mine the seabed under international law: (1) a state may authorize nonexclusive mineral collection operations. This approach is feasible but mining concerns will not accept its inherent instability; (2) a state may assume general resource sovereignty over a seabed area. This is clearly unacceptable in view of the 1958 Continental Shelf Convention; and (3) a state may exercise a specific resource sovereignty over a seabed area. No concise conclusion is drawn on this proposal although it is possible despite the difficulties of implementation. The effect of United Nations resolutions on each of these proposals is discussed. Proposition one is most widely accepted. (Walker-Florida)
W79-09460

THE GROUP OF 77 AT THE UNITED NATIONS: AN EMERGENT FORCE IN THE LAW OF THE SEA,
Assistant Secretary of Defense (International Security Affairs), Washington, DC.
A. Friedman, and C. Williams.
San Diego Law Review, Vol. 16, No. 3, p 555-575, April 1979.

Descriptors: *United Nations, *Law of the sea, *International law, *Political aspects, International waters, Political constraints, Water policy, Africa, Coasts, Water law.

The politics of a bloc of nations known as the Group of 77 (Group) is studied. The countries that comprise this bloc are variously referred to as 'less-developed countries', 'Third World Countries,' 'developing countries,' or 'underdeveloped countries.' A brief history of the Group's diplomacy in United Nations and the Group's role within the Law of the Sea Conference is detailed. Through illustrations of the Group's bloc-policy process, a model is constructed to explain the Group's behavior. The internal processes of the Group are explored, through an observational analysis of international group dynamics in a lawmaking context. The Group's unity is now less certain because of the many cross-cutting interests at stake in the Third United Nation Conference on the Law of the Sea. Western intransigence is cited as a unifying force for the Group under the 'common enemy' principle. (Coffey-Florida)
W79-09461

SYNOPSIS: RECENT DEVELOPMENTS IN THE LAW OF THE SEA 1977-1978,
R. Siref.
San Diego Law Review, Vol. 16, No. 3, p 705-733, April, 1979.

Descriptors: *Law of the sea, *United Nations, *International law, Water law, Political aspects, Political constraints, Mining, Fishing, Panama canal, Antarctic, Oil pollution.

The major events that occurred in the Law of the Sea between March 1977 and December, 1978 are surveyed. The Sixth and Seventh Sessions of the Third United Nations Conference on the Law of the Sea (UNCLOS III) are discussed at length. Other significant events discussed include: (1) United State Congressional legislation on the deep seabed mining question; (2) states unilateral extension of sovereignty over fishing waters; (3) the Panama Canal Treaty; (4) the Antarctic treaty states meeting to determine the future of Antarctica; (5) the Intergovernmental Maritime Consultative Organization's agreement on Oil Tanker Pollution Control; (6) the Mediterranean States' failure to agree on a comprehensive plan to prevent pollution of the Mediterranean; and (7) step taken to preserve the ocean's whales. Although many significant events occurred between March, 1977 and December 1978, in the Law of the Sea, UNCLOS continues to dominate events with attempts to develop a plan to govern the world's oceans. (Coffey-Florida)
W79-09462

CONDITION AND OPERATION STUDIES -- RECREATION: SECTION I: EVALUATION OF OPERATIONAL EFFECTIVENESS OF RECREATION SITES. SECTION II: INVESTMENT ANALYSIS OF RECREATION FACILITY DEVELOPMENT,
Army Engineer District, Sacramento, CA.
R. E. Brown, and W. J. Hansen.
IWR Research Report No. 78-R3, November 1978. Submitted to the U.S. Army Engineer Institute for Water Resources. 42 p, 2 fig, 26 tab, 20 ref, 2 append.

Descriptors: *Recreation facilities, *Recreation demand, *Investment, *Economic efficiency, Planning, Value engineering, Reservoir operation, Camping, Swimming, Water sports, Boat-launching ramps, Fishing, Multiple-purpose projects, Tourism, Use rates, Operation and maintenance, Management.

On-site sample surveys of visitor preferences, expectations, satisfactions, and dissatisfactions were taken at park and recreation areas on nine lakes during June through September 1972. Park managers were also interviewed to determine their judgement of the effectiveness of their own areas. A sample of the questionnaire used is included. Results show: (1) the correlation between manager expectation of visitor responses and the actual responses were poor; (2) lowest ranked facilities and services include swimming areas, restrooms, showers, and concession stands without food service and public telephones; (3) highest ranked facilities and services include roads, signs and information services, parking, water supply, camp grounds, boating accommodations, and concessions providing boat rental and food services; and (4) administrative procedures are needed for declaring old, poorly utilized, and nonserviceable facilities to be defunct. The cost-effectiveness of several recreational sites with respect to operation and maintenance costs were also analyzed. Economic efficiency appears to be an obvious but seldom used criterion for determining what kind and how many facilities should be included at a site. Investment analysis, benefits, and costs and management decisions are discussed. (Seigler-IPA)
W79-09472

POTENTIAL EFFECTS OF ENVIRONMENTAL POLICIES ON RESOURCE USE AND REGIONAL INCOMES IN AGRICULTURE,
Iowa State Univ., Ames.
G. F. Vocke, and E. O. Heady.
Agriculture and Environment, Vol. 4, No. 2, p 99-109, August, 1978. 1 fig, 6 tab, 8 ref.

Descriptors: Agriculture, *Crop production, *Economics, Environment, Fertilizers, Land management, *Land resources, Land use.

The results of this study indicate that U.S. agriculture can comply with restrictive environmental policies but not without significant consequences for farmers and their incomes. The imposition of a soil conservation policy alters crop production patterns, changes the regional distribution of agricultural incomes, and implies higher food expenses for consumers. A restriction on the use of nitrogen fertilizer requires substantial substitutes of other resources to maintain agricultural output. However, regional production patterns are altered, thus changing regional incomes from agriculture. A ban on the use of the organochlorine insecticides Chlordane and Heptachlor causes few major changes for agriculture but there is the potential that the incomes of some Midwest corn farmers may be drastically reduced by an insect infestation. Requiring feedlot operators to control the runoff from their feedlots will be particularly costly for small livestock producers but does not significantly alter regional livestock production patterns. Under high exports which are not restrained by environmental measures, land used for crops increases by 67 million acres, fertilizer use increases by 29 percent, and pesticide expenditures increase by 50 percent. When the several environmental restrictions are applied simultaneously, the value of exports must decline by 40 percent. Accompanying the reduction in exports is a 60 percent decline in soil erosion and a 30 percent reduction in nitrogen use. (Skogerboe-Colorado State)
W79-09505

6F. Nonstructural Alternatives

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. VOLUME I. BASIN PLAN,
Texas Governor's Planning Committee.
For primary bibliographic entry see Field 5F.
W79-09331

A PHANTOM DOCTRINE: THE ORIGINS AND EFFECTS OF JUST V. MARINETTE COUNTY (CONTROL OF LAKE SHORE EROSION THROUGH FILL PERMITS),
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 6E.
W79-09457

6G. Ecologic Impact Of Water Development

DIVE STUDIES AT TWIN LAKES, COLORADO, 1974-75,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. F. LaBounty, R. A. Crysdale, and D. W. Eller.
Report No. REC-ERC-76-15, September 1976. 29 p, 27 fig, 4 tab, 5 ref, 1 append.

Descriptors: *Twin Lakes, *Colorado, *Mt Elbert pumped-storage powerplant, *Environmental effects, *Limnology, Pumped storage, Scuba diving, Lakes, Reservoirs, Aquatic habitats, Aquatic life, Lake trout, Shrimp, Aquatic plants.

Three separate SCUBA (Self-Contained Underwater Breathing Apparatus) dives were made at Twin Lakes, Colorado, to obtain a qualitative perspective of the aquatic environments of the lakes.

This data, combined with existing quantitative data, will provide a comprehensive base of ecological information on the lakes. The lakes are being enlarged to serve as the powerplant afterbay for the Mt. Elbert Pumped-Storage Powerplant. The plants pumpback capability and generation mode have the potential to substantially modify the aquatic ecosystem. Qualitative data are in the form of plant and animal observations, underwater photography, aquatic plant identification, and descriptions of bottom characteristics. Results show that both lakes contain numerous rocks ideal for lake trout spawning areas. Mysis shrimp were observed in both lakes with a high density near the powerplant tailrace. Fish observed include lake trout, suckers, rainbow trout, and smelt. Lake bottoms were found to be rocks and gravel interspersed with vegetation in shallow areas and easily disturbed glacial flour in the deep flat bottom areas. Details of diving methods are provided to illustrate the use of SCUBA diving in ecological studies of high altitude lakes. (Seigler-IPA)
W79-09424

HABITAT EVALUATION,
Fish and Wildlife Service, Fort Collins, CO.
M. Schamberger.
Water Spectrum, Vol. 11, No. 2, p 26-34, Spring 1979. 9 fig.

Descriptors: *Habitats, *Wildlife habitats, *Developed waters, *Water resources development, Recreation facilities, Fish management, Environmental effects, Preservation, Reservoirs, Habitat Evaluation Procedures, Mitigation, Birds, Habitat productivity.

Habitat Evaluation Procedures (HEP), a methodology designed to provide an objective and quantitative estimate of the 'value' of fish and wildlife resources, is discussed. Environmental protection is an important aspect of all water-related planning management decisions. One of the greatest problems associated with the protection of fish and wildlife is the difficulty of quantifying their value. The traditional methodology, 'man-day of use' considers neither the quality of the resource nor the amount of resource available, and can result in a distorted picture of the actual impact to fish and wildlife that results from project implementation. The HEP was designed to overcome the problems associated with the man-day of use approach on the habitat and its associated productivity. The HEP can be used at all stages of resource project planning. They provide a standardized data base to assess impacts on fish and wildlife for the evaluation of alternate project sites and plans to determine what measures, if any, are needed for mitigation and/or compensation. The greatest value of the HEP is their application and usefulness throughout the planning process. (Seigler-IPA)
W79-09467

7. RESOURCES DATA

7B. Data Acquisition

SYMPOSIUM ON THE PHYSICS AND CHEMISTRY OF ICE,
For primary bibliographic entry see Field 2C.
W79-09342

DIELECTRIC PERMITTIVITY OF GLACIER ICE MEASURED IN SITU BY RADAR WIDE-ANGLE REFLECTION,
Wisconsin Univ.-Madison. Geophysical and Polar Research Center.
For primary bibliographic entry see Field 2C.
W79-09366

TROPHIC CLASSIFICATION OF SELECTED COLORADO LAKES: LAKE CLASSIFICATION THROUGH THE AMALGAMATION OF CONTACT-SENSED DATA AND DIGITALLY PROCESSED MULTISPECTRAL SCANNER DATA ACQUIRED BY SATELLITE AND AIRCRAFT,
Jet Propulsion Lab., Pasadena, CA.
R. J. Blackwell, and D. H. Boland.
Report No. EPA-600/4-79-005, JPL Publication 78-100, January 1979. Prepared for the National Aeronautics and Space Administration, Washington, D.C. and the U.S. Environmental Protection Agency, Office of Research and Development, Las Vegas, Nevada. 210 p, 36 fig, 51 tab, 82 ref, 3 append.

Descriptors: *Remote sensing, *Landsat, *Trophic level, *Multispectral scanners, *Modular multispectral scanning, Colorado, Lakes, Data collections, Aircraft, Photographs, Monitoring, Lake morphometry, Areal, Surfaces.

An examination was made of the role of Landsat multispectral scanner (MSS) data when used with contact-sensed data in lake monitoring and survey programs. Attention was focused on Landsat, but data acquired from an aircraft-borne modular multispectral scanner (MMS) were also examined. The scanners were evaluated on their ability to do the following: estimate lake surface area, lacustrine trophic state, and several trophic indicators including Secchi disc, transparency, and chlorophyll a; and aid in the development of lake thematic photomaps. Contact-sensed, Landsat MSS, and MMS data relationships for nine Colorado lakes indicated: (1) both Landsat MSS and Bendix MMS give estimates of lake surface area which are of practical value, with the MMS yielding slightly better results; (2) regression models were developed from both MSS and MMS data for the prediction of specific trophic indicators, with the MSS-related model giving better estimates than the Landsat MSS-related model; (3) estimation of a numeric trophic state index was shown to be possible through the development of regression models using contact-sensed data and either MSS or MMS data, with the MMS-related model providing better estimates than the Landsat model; and (4) production of trophic index photomaps was feasible using contact-sensed data and either MSS or MMS data, with the MMS product being more accurate than the Landsat product. (Schaefer-IPA)
W79-09420

REMOTE SENSING APPLICATIONS TO HYDROLOGIC MODELING IN THE SOUTHERN SIERRA NEVADA AND PORTIONS OF THE SAN JOAQUIN VALLEY, VOL. I,
California Univ., Santa Barbara. Dept. of Geography.
J. Dozier, J. E. Estes, D. S. Simonett, R. Davis, and J. Frew.
Available from the National Technical Information Service, Springfield, VA 22161 as E78-10126, Price codes: A07 in paper copy, A01 in microfiche. Final Report, May 1978. For January 17, 1977 to March 16, 1978. 125 p, 25 fig, 17 tab, 105 ref, 1 append. NASA NSG-5155.

Descriptors: *Remote sensing, *Hydrologic data, *Hydrologic aspects, *Model studies, Albedo, Radiation, Snowpacks, Snow cover, Topography, Atmospheric physics, Cloud cover, San Joaquin Valley, Sierra Nevada Mountains, California, Analytical techniques, Satellites(Artificial), Landsat, Fergana Valley, USSR.

Part of a joint U.S. - U.S.S.R. cooperative project to apply remote sensing to hydrologic modeling and to develop an energy balance snowmelt model for large basins is presented. Methods for estimating the various soil thermal and hydraulic parameters required for input to soil-heat moisture transfer models were determined. Various models were surveyed and a list of attributes for the Southern Sierra model of soil-snow heat and moisture exchange was developed. A technique for modeling incoming longwave radiation in mountainous terrain was developed. This model should compute the variations in atmospheric emissivity, account for the effects of surrounding slopes, cloud cover, and forest cover; and be driven by a limited set of discontinuous surface measurements. A method for estimating the shortwave albedo of an alpine snow cover using satellite radiance measurements is presented. Relevant spatial, radiometic, spectral, and temporal characteristics of Landsat data are included. A topographic solar radiation algorithm for snowmelt modeling is discussed. The algorithm should be spectral and computationally economical, account for radiation variations, include calculations for reflected radiation, provide for attenuation by clouds, and be able to estimate atmospheric attentuation parameters. A preliminary description of the Soviet test site, the Fergana Valley, is included. (Schaefer-IPA)
W79-09422

APPLICATION OF LANDSAT TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES,
Delaware Univ., Newark. Center for Remote Sensing.
V. Klemas, D. Bartlett, G. Davis, W. Philpot, and R. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-17441, Price codes: A07 in paper copy, A01 in microfiche. Final Report for Period February 1976 - December 1977. Prepared for National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD. 1977, 141 p, 50 fig, 7 tab, 50 append. NAS5-20983.

Descriptors: *Landsat, *Remote sensing, *Watershed management, Wetlands, Satellites(Artificial), Data collections, Hydrologic data, Water pollution effects, Sediment distribution, Vegetation, Algae, Estuaries, Water management(Applied), Delaware.

Analysis of Landsat imagery was found to be useful in a number of applications to Delaware's marine and coastal environment. Satellite observations proved valuable in mapping the location, type, and extent of estuarine fronts in Delaware Bay over all portions of the tidal cycle. The observations agreed with boat measurements and model predictions. Oil slick prediction models for clean-up operations of oil slicks and other pollutants will benefit from aircraft tracking of the actual slicks and from Landsat observations of surface currents and frontal systems. A method is presented for determining by remote sensing the concentration of suspended sediment with only a limited amount of ground truth. Landsat was shown to offer an effective means of monitoring the dispersion and movement of ocean dump plumes, such as industrial waste dumped on the continental shelf. A technique is described to analyze coastal vegetation, by obtaining Landsat/multispectral scanner (MSS) - equivalent spectral radiances in situ and the transforming these and actual MSS data to atmospherically corrected reflectance values. Interpretation of Landsat data was shown to be a valid and valuable technique for evaluating the onshore impacts of offshore petrochemical development; the study site for this was the Kenai Region, Alaska. (Schaefer-IPA)
W79-09423

PRELIMINARY RESULTS OF PASSIVE MICROWAVE SNOW EXPERIMENT DURING FEBRUARY AND MARCH 1978,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. T. C. Chang, J. C. Shiue, H. Boyne, D. Ellerbruch, and G. Counas.
Available from the National Technical Information Service, Springfield, VA 22161 as N79-19519, Price codes: A06 in paper copy, A01 in microfiche. Report No. NASA TP-1408, March 1979. 113 p, 16 fig, 1 tab, 5 ref, 2 append.

Descriptors: *Remote sensing, *Snowpacks, *Runoff, *Microwaves, *Radiometers, *Water management, Colorado, Rocky Mountains, Ground truth, Density stratification, Snow management, Snowmelt, Water yield, Hydrology, Particle size.

A four-frequency microwave radiometer system attached to a truck-mounted aerial lift was used to gather data on snowpacks at three sites in the Colorado Rocky Mountains. The experiment was designed to determine if remote microwave sensing of snowpacks could be used to predict runoff amounts. Runoff from melting snow provides more than 65% of the stream-flow for most of the mountainous western United States. Accurate runoff prediction would allow more efficient management of water for hydropower generation, irrigation,

and domestic and industrial water use. Snow depth, density, and non-uniform vertical grain-size distribution were calculated from the radiometric data. These values were compared to actual measured ground truth data (density, temperature, grain size, hardness, and free-liquid water content) taken at corresponding sites. Results show a positive agreement and potential for using remote sensing for runoff forecasts. Ground truth and snow brightness temperatures data are included. (Seigler-IPA)
W79-09430

PRELIMINARY RESULTS OF SAR SOIL MOISTURE EXPERIMENT, NOVEMBER 1975,
Computer Sciences Corp., Silver Spring, MD.
B. J. Choudhury, A. T. C. Chang, V. V. Salomonson, T. Schmugge, Jr., and J. R. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as N79-16473, Price codes: A03 in paper copy, A01 in microfiche. Report No. NASA TP-1404, January 1979. 20 p, 5 fig, 2 tab, 12 ref.

Descriptors: *Soil moisture, *Synthetic aperture radar, *Terrain analysis, *Remote sensing, Missouri, Indiana, Soil surveys, Back scattering, Moisture content, C-46 aircraft, Polarization, Image films, X-band, L-band, Microwave images.

A synthetic aperture radar (SAR) system was used to measure soil moisture at sites in St. Charles, Missouri; Centralia, Missouri; and Lafayette, Indiana. The test sites were 4.83-km by 8.05-km rectangular strips of relatively flat terrain. Moisture ground truth measurements were made in a number of bare fields at each location. The Environmental Research Institute of Michigan's (ERIM) dual-frequency and dual-polarization side-looking SAR system on board a C-46 aircraft was used for the experiment. Operating frequencies were 1.304 GHz and 9.375 GHz. Horizontally polarized pulses were transmitted and both horizontally and vertically polarized return signals were recorded on the signal film simultaneously for each frequency. Ground soil sample of 0 to 2.5 cm and 0 to 15 cm layers were also collected for soil moisture estimation. Digital data and hard-copy image films from the optical processing of the signal films were analyzed and the relationship of radar backscatter to moisture content and surface roughness is discussed. Many difficulties associated with the processing and analysis of SAR imagery such as the uncertainty in the quantitative analysis due to the difficulty of quality reproduction of digital data from the signal films are discussed. Results indicate some potential for applying the SAR approach for soil moisture determination if these problems can be solved. (Seigler-IPA)
W79-09431

LANDSAT FOLLOW-ON INVESTIGATION NO. 22510: THE USE OF THE LANDSAT DATA COLLECTION SYSTEM AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, MA. New England Div.
S. Cooper, T. D. Buckelew, H. L. McKim, and C. J. Merry.
Available from the National Technical Information Service, Springfield, VA 22161 as E78-10102, Price codes: A08 in paper copy, A01 in microfiche. Final Report, November 1977. Prepared for the National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD. 157 p, 86 fig, 10 tab, 53 ref, 2 append.

Descriptors: *Landsat, *Remote sensing, *Reservoir operation, *Watershed management, Water resources development, Reservoirs, Satellites(Artificial), Data collections, Hydrologic data, Wetlands, Analytical techniques, River forecasting.

Progress made by the New England Division, Corps of Engineers (NED) in utilizing Landsat data and imagery products in watershed management is documented. A description of sensors and interfaces developed for measuring water related parameters is included. In the investigation of the Landsat data collection system (DCS) it was shown that: (1) the reliability of the data collection platforms, Landsat itself, and NED's downlink were high; (2) component redundancy was an important consideration; (3) a potential increase in ability to function in the flood control mission was due to the installation of the DCS downlink; (4) a single Landsat was suitable for data needed daily or twice daily; (5) costs of the system could be less than comparable line-of-site radio systems; and (6) a geosynchronous satellite having random reporting would be the ideal system. The investigation showed that the Landsat DCS is suitable for monitoring events for which dependable sensors are available; a system of polar-orbiting satellites would be useful for collection of hydrologic data such as river stage and precipitation. It is recommended that the Landsat digital data be used in regional evaluation of wetlands when a mapping accuracy of 75% is required. (Schaefer-IPA)
W79-09437

SIERRA COOPERATIVE PILOT PROJECT, 1977-78 DATA INVENTORY, PROJECT SKYWATER.
Bureau of Reclamation, Denver, CO. Office of Atmospheric Resources Management.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 405, Price codes: A07 in paper copy, A01 in microfiche. June 1978. 130 p, 33 fig, 37 tab.

Descriptors: *Weather modification, *Weather data, *Cloud seeding, Cloud physics, Meteorology, Instrumentation, Sierra Nevada Mountains, Nevada, California, Sierra Cooperative Pilot Project, Data collections, Satellites(Artificial), Aircraft, Landsat, Precipitable water.

A complete inventory of all data collected in association with the Sierra Cooperative Pilot Project (SCPP) during the 1977-78 winter season is presented. The information is divided into 13 sections: (1) site maps; (2) radar; (3) satellite; (4) aircraft; (5) rawinsondes and pibals; (6) acoustic sounder; (7) precipitation gages; (8) snow profile; (9) joss disdrometer; (10) ice crystal and ice nucleus; (11) transport and diffusion; (12) project surface observations; and (13) National Weather Service (NES), Federal Aviation Administration (FAA), and National Climatic Center products. Most of the sections are further subdivided into: (1) a general description of equipment, modes of operation, and types of data available for analyses (both visual products and computer files); (2) samples of primary visual products; and (3) tables of data inventories which list start and stop times, locations, and other pertinent information related to data sampling. (Schaefer-IPA)
W79-09438

DESCRIPTION AND FIELD TEST RESULTS OF AN IN SITU COLIFORM MONITORING SYSTEM,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
D. C. Grana, and J. R. Wilkins.
NASA Technical Paper 1334. 1979. 36 p, 23 fig, 1 tab, 5 ref.

Descriptors: *Coliforms, *Monitoring, *Aquatic bacteria, Electrochemistry, Standards, Water pollution, Bacteria, Water pollution sources, Microbiology, Data collections, Instrumentation, Bioindicators, Indicators.

A prototype in situ system for monitoring the levels of fecal coliforms in shallow water bodies is presented. The basis for the system was the known relationship between the concentration of the coliform bacteria and the amount of hydrogen they produce during growth in a complex organic media. The prototype consists of three parts: (1) a sampler platform at the bottom of the water; (2) a surface buoy which transmits samples-generated data; and (3) a shore station which receives, displays the data, and controls the sampler. The system was evaluated at four sites (three estuarine and one fresh water) which were characterized by a range of fecal coliforms from less than 1 to 2,000 per 100 ml of water. The evaluation verified the concept of remote monitoring of fecal coliform concentrations by an electrochemical detection method (EDM). The prototype system is envisioned as a monitoring tool rather than as a regulatory tool. A description of the test sites, results for each site, test preparation and procedures, and data analyses are included. (Schaefer-IPA)
W79-09439

TEST AND EVALUATION OF POTASSIUM SENSORS IN FRESH- AND SALTWATER,
National Ocean Survey, Rockville, MD.
G. K. Ward.
Report No. EPA-600/7-79-057, March 1979. Interagency Energy/Environment R and D Program Report. 61 p, 29 fig, 8 tab, 3 ref, 1 append. EAP-78-BEA.

Descriptors: *Potassium, *Electrodes, *Analytical techniques, Monitoring, Chemical analysis, Variability, Freshwater, Sea water, Atlantic Ocean, Chesapeake Bay, Stability, Light intensity, Instrumentation, Measurement, Calibrations.

Three types of potassium ion-selective electrodes, a glass-membrane single electrode, a glass-membrane combination electrode, and a liquid ion-exchange electrode, were tested and evaluated for suitability in monitoring or in situ chemical analysis systems. The electrodes were manufactured by different companies and were tested for accuracy, precision, temperature dependence, stability, durability, light intensity sensitivity, flow conditions variations, response time as a function of temperature and potassium concentration, and manufacturer variations. Tests were conducted in various types of water (Atlantic Ocean water, Chesapeake Bay Water, synthetic seawater, and fresh water) at 10C and 25C. Results show: (1) none of the electrodes exhibited a pure Nernstian behavior with a Nernst theoretical slope, (2) all three electrodes had significant drift problems, (3) an accuracy of 5% in concentration could be achieved with some sensors with proper and frequent calibration, (4) response times were long for all sensors -- generally greater than 10 minutes, (5) the two glass-membrane sensors were sensitive to motion and flow variations, and (6) all electrodes performed well in freshwater with slight differences in seawater. Recommendations for future development are included. (Seigler-IPA)
W79-09486

EVALUATION OF CALCIUM SENSORS IN FRESH - AND SALTWATER,
National Ocean Survey, Rockville, MD.
G. K. Ward.
Report No. EPA-600/7-79-058, March 1979. Interagency Energy/Environment R and D Program Report. 36 p, 16 fig, 6 tab, 4 ref, 1 append. EAP-78-BEA.

Descriptors: *Calcium, *Electrodes, *Analytical techniques, Chemical analysis, Measurement, Monitoring, Freshwater, Sea water, Atlantic Ocean, Chesapeake Bay, Stability, Light intensity, Calibrations.

The Orion Calcium Ion Electrode no. 93-20 was evaluated for its performance and accuracy in samples from freshwater, estuarine, and seawater environments. The electrode was tested with three separate 'liquid ion-exchange' type sensor modules. Descriptions of the sensor, operation, tests, and results are provided. Test parameters were; accuracy, precision, temperature dependence, stability, durability, sensitivity to fluctuations in light intensity and flow conditions, response time, and variability between modules. Evaluations were made at 10C and 25C in freshwater, synthetic seawater, and natural waters. Results show: (1) all sensors failed before their 'expiration dates', (2) the hard plastic electrodes are physically durable, (3) amount of available light had no effect, (4) all modules had a linear response in seawater, (5) reproducibility of a plus or minus 4% claimed by the manufacturer holds only if the sensor is calibrated hourly, and (6) the calcium electrode should not be used in freshwater without an ionic strength adjustor. The long response times (average of 33 minutes in freshwater) and sensitivity to flow conditions make

application of this calcium sensor to in situ measurements impractical. (Seigler-IPA)
W79-09487

STUDY OF WATER RESOURCES WITH THE AID OF SPACECRAFT IN THE UNITED STATES,
L. V. Dunin-Barkovskiy.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-27651, Price codes: A02 in paper copy, A01 in microfiche. NASA Technical Translation F 17, 112, July 1976. 18 p, 1 tab, 5 ref. Translation of 'Izucheniye vodnykh resursov s pomoshch'yu kosmicheskikh sredstv v SShA', Vodnyye resursy, No. 1, p 60-68, 1976.

Descriptors: *Remote sensing, *Satellites(Artificial), *Reviews, *United States, Reservoirs, Mathematical models, Floods, Water quality, Vegetation, Water resources.

A detailed study was made of the results of research using remote sensing for studying water resources in the United States. Research on using remote sensing for studying water resources has been assigned by the National Aeronautics and Space Administration to certain universities and specialized firms for several years. For this purpose, manned and artificial Earth satellites have been used. However, before the stage of practical use it has only been possible to carry out a limited amount of research, which includes the following: determining the rain runoff from reservoirs in an arid zone, establishing the regions of flooding by flood waters, and determining the pollution of estuaries and bays. (Sims-ISWS)
W79-09501

A COMPUTER SOFTWARE SYSTEM FOR INTEGRATION AND ANALYSIS OF GRID-BASED REMOTE SENSING DATA WITH OTHER NATURAL RESOURCE DATA,
Michigan State Univ., East Lansing. Remote Sensing Project.
S. E. Tilmann, W. R. Enslin, and R. Hill-Rowley.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-16418, Price codes: A02 in paper copy, A01 in microfiche. Report, February 1977. 12 p, 3 fig, 3 tab, 1 ref. NASA NGL23-044-083.

Descriptors: *Remote sensing, *Michigan, *Data processing, *Computer programs, Natural resources, Land use, Water pollution, Water pollution sources, Waste disposal, Groundwater recharge, Erosion, Topography, Satellites(Artificial), Aircraft, Analytical techniques, *Windsor Township(MI), *Eaton County(MI).

This report described a computer-based information system designed to assist in the integration of commonly available spatial data for regional planning and resource analysis. The Resource Analysis Program (RAP) provides a variety of analytical and mapping phases for single factor or multifactor analyses. The unique analytical and graphic capabilities of RAP were demonstrated with a study conducted in Windsor Township, Eaton County, Michigan. For this study, soil, land cover/use, topographic and geological maps were used as a data base to develop an 11-map portfolio. The major themes of the portfolio were land cover/use, non-point water pollution, waste disposal, and groundwater recharge. (Sims-ISWS)
W79-09504

WATER WELL DRAW DOWN MONITORING SYSTEM,
Electromeasures, Inc., Ennis, TX. (Assignee).
C. D. Deal.
U.S. Patent No. 4,142,411, 7 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 1, p 58, March 6, 1979.

Descriptors: *Patents, *Measurement, *Drawdown, *Water wells, Flow measurement, Water table, Monitoring, Well data, Specific capacity, Electronic equipment.

A method and apparatus is described for measuring the draw down of a water well by making in situ measurements of the static and dynamic water table levels. A well bore located pressure sensor provides the hydrostatic pressures to a surface located electronic measuring unit which provides a draw down measurement directly in terms of feet of water. An extension of the method provides for combining the measured draw down parameter with water discharge pressure and water flow measurements to derive a set of data which uniquely characterizes the production capability of the well. The apparatus performs all measurements automatically and has provisions for producint a time history of the well parameters, and telemetering to a central station for monitoring and processing. (Sinha - OEIS)
W79-09517

BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS,
Environmental Research Inst. of Michigan, Ann Arbor.
For primary bibliographic entry see Field 2L.
W79-09525

7C. Evaluation, Processing and Publication

WATER-RESOURCES INVESTIGATIONS IN KANSAS--FISCAL YEAR 1978,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. McGovern, and L. J. Combs.
Geological Survey open-file report 79-561, January 1979. 85 p, 5 fig, 5 tab.

Descriptors: *Water resources, *Projects, *Kansas, *Water quality, *Available water, Groundwater resources, Surface waters, Data collections, Streamflow, Hydrogeology, Water wells, Aquifers, Sampling, Measurement, Sites, Maps, Publications.

Hydrologic investigations in Kansas during fiscal year 1978 consisted of collecting and analyzing data to assess the State's water resources, describe the framework of hydrologic systems, and provide quantity and quality of water data for optimum development and management. Surface-water studies were made to analyze long-term records of streamflow, basin and stream-channel characteristics, relations of rainfall and runoff, frequency of low flows and floods, interrelation of ground and surface water, and the effects of stream regulation on the quantity, quality, and availability of water supplies. Geohydrologic studies were made to determine the source, availability, quantity, and quality of water in the principal aquifers; evaluate long-range effects of irrigation, industrial, and municipal withdrawals; determine the potential for storage of liquid wastes; and prepare digital models for evaluating plans of aquifer development and management. Water-quality studies were made to define the physical, chemical, and biological character of surface and ground water; the origin transport, and character of solutes and sediment in streams; the areal and temporal changes in water quality; and the suitability of water for municipal, industrial and agricultural use. (Woodard-USGS)
W79-09394

APPROXIMATE WATER-LEVEL CHANGES IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS 1977-79, AND MEASURED COMPACTION 1973-79, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
R. K. Gabrysch.
Geological Survey open-file report 79-693, 1979. 5 sheets, 5 fig.

Descriptors: *Aquifers, *Groundwater, *Water wells, *Water level fluctuations, *Compaction, Land subsidence, Maps, Texas, *Chicot aquifer, *Evangeline aquifer, *Galveston County(Tex), *Harris County(Tex).

This report consists of: (1) Four maps that present data on water-level changes during 1977-79 in the Chicot and Evangeline aquifers and; (2) one set of graphs that present data on the compaction of subsurface materials for 1973-79. During 1977-79, groundwater pumping decreased in Galveston County and southern Harris County, Tex., and increased in northern and western Harris County. (Woodard-USGS)
W79-09395

WATER-RESOURCES INVESTIGATION OF THE U.S. GEOLOGICAL SURVEY IN MONTANA, OCTOBER 1978 THROUGH SEPTEMBER 1979.
Geological Survey, Helena, MT. Water Resources Div.
Geological Survey open-file report 79-418, April 1979. 40 p, 3 fig, 2 tab.

Descriptors: *Data collections, *Sites, *Hydrologic data, *Projects, *Montana, Water quality, Surface waters, Groundwater, Available water, *US Geological Survey investigations.

The report describes water-resources investigations of the U.S. Geological Survey in Montana, October 1978 through September 1979. Programs consist of (1) collecting hydrologic data on a continuing basis, (2) conducting water-resources appraisals of surface and ground water, (3) conducting supportive research in hydrology and related fields, (4) disseminating water data and results of investigations to the public, (5) coordinating acquisition of water data by Federal agencies, and (6) providing technical assistance in hydrologic fields to other government agencies. (Woodard-USGS)
W79-09397

WATER RESOURCES DATA FOR KENTUCKY, WATER YEAR 1978.
Geological Survey, Louisville, KY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 401, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report KY-78-1, March 1979. 502 p, 5 fig, 3 tab.

Descriptors: *Kentucky, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Kentucky consist of records of stage, discharge, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs. This report contains discharge records from 114 gaging stations; stage and contents for 14 lakes; water-quality for 29 stations; suspended-sediment data for 36 stations (6 daily); daily temperature for 40 stations; ground-water levels for 65 recording, 71 partial, and 1 flowing well; water-quality data from 5 springs and 30 wells; and miscellaneous temperature and specific conductance data from the 114 gaging stations. Also included are data for 126 partial-record crest-stage and 126 partial-record low-flow sites. Data collected at various miscellaneous sites are also included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kentucky. (Woodard-USGS)
W79-09399

WATER RESOURCES DATA FOR SOUTH CAROLINA, WATER YEAR 1977.
Geological Survey, Columbia, SC. Water Resources Div.
Geological Survey Water-Data Report SC-77-1, March 1978. 232 p, 5 fig.

Descriptors: *South Carolina, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 57 gaging stations, stage-only records for 1 gaging stations, stage and contents for 11 lakes and reservoirs, water quality for 19 gaging stations and 6 ungaged stations, and water levels for 24 observation wells. Also included are 48 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Carolina. (Woodard-USGS)
W79-09404

WATER RESOURCES DATA FOR SOUTH DAKOTA, WATER YEAR 1978.
Geological Survey, Huron, SD. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 426, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report SD-78-1, March 1979. 323 p, 6 fig.

Descriptors: *South Dakota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for South Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 103 gaging stations, stage and contents for 9 lakes and reservoirs, water quality for 25 gaging stations and 62 wells, and water levels for 16 observation wells. Also included are 101 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Dakota. (Woodard-USGS)
W79-09405

HEADWATER LOCATIONS OF U.S. STREAMS TRIBUTARY TO ST. LAWRENCE RIVER BASIN BETWEEN WESTERN OHIO AND EASTERN NEW YORK, EXCLUDING LAKE CHAMPLAIN BASIN,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W79-09408

WATER-TABLE MAP OF KENOSHA COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
M. G. Sherrill, and J. J. Schiller.
Geological Survey Water-Resources Investigations 79-39 (open-file report), May 1979. 1 sheet, 5 ref.

Descriptors: *Maps, *Water table, *Altitude, *Contours, *Groundwater, Wisconsin, *Kenosha County(WI).

A map (scale 1:100,000) of the water table in Kenosha County in southeastern Wisconsin was prepared using water levels from more than 200 wells. The work was done as a cooperative project between the U.S. Geological Survey and the Southeastern Wisconsin Regional Planning Commission. The map shows the altitude of the water table in increments of 20 feet, with supplemental 10-foot contours. The altitude ranges from less than 580 feet at a point near Lake Michigan to more than 840 feet at a point near the western border of the county. (Woodard-USGS)
W79-09411

WATER-TABLE MAP OF MILWAUKEE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
M. G. Sherrill, J. J. Schiller, and J. R. Erickson.
Geological Survey Water-Resources Investigations 79-40 (open-file report), May 1979. 1 sheet, 5 ref.

Descriptors: *Maps, *Water table, *Altitude, *Contours, *Groundwater, Wisconsin, *Milwaukee County(WI).

A map (scale 1:100,000) of the water table in Milwaukee County in southeastern Wisconsin was prepared using water levels from more than 135 wells. The work was done as a cooperative project between the U.S. Geological Survey and the Southeastern Wisconsin Regional Planning Commission. The map shows the altitude of the water table in increments of 20 feet. The altitude ranges from less than 540 feet in a cone of depression in the city of Milwaukee to more than 800 feet in an area along the western border of the county. (Woodard-USGS)
W79-09412

WATER-TABLE MAP OF RACINE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
M. G. Sherrill, and J. J. Schiller.
Geological Survey Water-Resources Investigations 79-41 (open-file report), May 1979. 1 sheet, 5 ref.

Descriptors: *Maps, *Water table, *Altitude, *Contours, *Groundwater, Wisconsin, *Racine County(WI).

A map (scale 1:100,000) of the water table in Racine County in southeastern Wisconsin was prepared using water levels from more than 250 wells. The work was done as a cooperative project between the U.S. Geological Survey and the Southeastern Wisconsin Regional Planning Commission. The map shows the altitude of the water table in increments of 20 feet, with supplemental 10-foot contours. The altitude ranges from less than 520 feet at a point in a cone of depression in the eastern part of the county to more than 820 feet at two points, one along the border in the southwestern corner of the county and another in the northwestern corner. (Woodard-USGS)
W79-09413

WATER-TABLE MAP OF WALWORTH COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
M. G. Sherrill, and J. R. Erickson.
Geological Survey Water-Resources Investigations 79-42 (open-file report), May 1979. 1 sheet, 3 ref.

Descriptors: *Maps, *Water table, *Altitude, *Contours, *Groundwater, Wisconsin, *Walworth County(WI).

A map of the water table in Walworth County in southeastern Wisconsin was prepared using water levels from nearly 600 wells. The work was done as a cooperative project between the U.S. Geological Survey, the University of Wisconsin-Extension, Geological and Natural History Survey, and the Southeastern Wisconsin Regional Planning Commission. The map (scale 1:100,000) shows the altitude of the water table in increments of 20 feet, with supplemental 10-foot contours. The altitude ranges from less than 780 feet along parts of the eastern border of the county to more than 1,000 feet in a small area near the central part of the county. (Woodard-USGS)
W79-09414

WATER-TABLE MAP OF WAUKESHA COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
J. B. Gonthier.
Geological Survey Water-Resources Investigations 79-43 (open-file report), May 1979. 1 sheet, 7 ref.

Descriptors: *Maps, *Water table, *Altitude, *Contours, *Groundwater, Wisconsin, *Waukesha County(WI).

A map (scale 1:100,000) was prepared of the water table in Waukesha County in southeastern Wisconsin using water levels from more than 1,700 wells. The work was done as part of a cooperative project between the U.S. Geological Survey, the University of Wisconsin-Extension, Geological and Natural History Survey, and the Southeastern Wisconsin Regional Planning Commission. The map shows the altitude of the water table in increments of 20 feet, with supplemental 10-foot contours. The altitude ranges from less than 670 feet at a point along the east border of the county to more than 1,000 feet above sea level at three points in the central part of the county. (Woodard-USGS)
W79-09415

MULTILEVEL APPROACH TO URBAN STORM WATER SYSTEMS PLANNING,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6A.
W79-09488

8. ENGINEERING WORKS

8B. Hydraulics

PROGRESS REPORT TO THE ARKANSAS STATE HIGHWAY AND TRANSPORTATION COMMISSION FOR YEAR ENDING SEPTEMBER 30, 1978,
Geological Survey, Little Rock, AR. Water Resources Div.
M. S. Hines.
Geological Survey open-file report 79-523, 1979. 22 p, 1 plate, 1 tab.

Descriptors: *Floods, *Peak discharge, *Hydraulics, *Bridge design, *Arkansas, Open channel flow, Flood frequency, Drainage area, Streamflow, Flow rates, Hydrologic data, Geomorphology, Planning, Road design, Rainfall-runoff relationships.

The economic design of bridges and culverts requires a knowledge of the magnitude and frequency of floods for all size drainage basins. In addition, an analysis of the hydrologic and hydraulic characteristics at specific sites where unusual circumstances exist is a prerequisite to design. The Arkansas State Highway and Transportation Commission and the U.S. Geological Survey have a mutual interest in flood-frequency and open-channel hydraulics and are therefore cooperating in a program to provide information necessary to meet their objectives. This report summarizes peak stages and discharges for 106 sites on Arkansas streams. Drainage areas for the Ouachita River basin were delineated, planimetered, and compiled. A drainage-area report for the Red River basin was published in May 1978. Geological Survey personnel assisted in a dye study of flow direction and velocity in the Arkansas River at the East Belt Freeway crossing. (Woodard-USGS)
W79-09396

8E. Rock Mechanics and Geology

GUIDELINES MANUAL FOR SURFACE MONITORING OF GEOTHERMAL AREAS,
Woodward-Clyde Consultants, San Francisco, CA.
C. J. Van Til.
Available from the National Technical Information Service, Springfield, VA 22161 as LBL-8617, Price codes: A07 in paper copy, A01 in microfiche. Final Report No. LBL-8617, GSRMP-3, UC-66e, May 1979. Prepared for the U.S. Department of Energy, Geothermal Subsidence Research Management Program. 126 p, 30 fig, 12 tab, 38 ref, 7 append. W-7405-ENG-48.

Descriptors: *Geothermal studies, *Subsidence, *Monitoring, Energy conversion, Land subsi-

dence, Movement, Stress, Earth pressure, Geology, Soil compaction, Subsurface waters, Geologic investigations, Hydrogeology, Environmental effects, Maps, Aerial photography.

Guidelines are presented for the establishment of a program for the monitoring of surface movements (primarily subsidence) associated with the production of energy from a geothermal source. The major process which may cause subsidence in geothermal areas is considered to be the loss of pore space due to fluid withdrawal. Compaction of these intergranular pore spaces accounts for the major portion of subsidence, but experiments on rock core samples indicate that an increase in effective stress may also reduce the volume of fracture pore space. Purposes for monitoring include: (1) satisfaction of legal requirements, (2) protection of environmental features, (3) protection of man-made structures, (4) collection of data for enforcement purposes, (5) checking of engineering design features to reduce subsidence, and (6) research. Three major logical steps for developing a monitoring program are presented. The first, preliminary investigation, describes the basic types of information needed and what the information will be used for. Types of information include: geological maps and reports, topographic maps, aerial photographs, soil maps, climate and weather records, and site inspection. Design of the monitoring system, the second step, includes: defining the site, regional survey work, local survey work, and special monitoring. The third step, monitoring operations, involves construction, scheduling, measurements, and data handling. (Seigler-IPA)
W79-09485

8I. Fisheries Engineering

PREFERRED AND OBSERVED CONDITIONS FOR SOCKEYE SALMON IN OZETTE LAKE AND ITS TRIBUTARIES, CLALLAM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. C. Bortleson, and N. P. Dion.
Geological Survey Water-Resources Investigations 78-64 (open-file report), 1979. 61 p, 17 fig, 6 tab, 17 ref.

Descriptors: *Sockeye salmon, *Spawning, *Stream fisheries, *Lake fisheries, Water quality, Water temperature, Dissolved oxygen, Fish physiology, Ecosystems, Streambeds, Lake beds, Gravels, Evaluation, Washington, *Ozette Lake, *Clallam County(Wash).

Ozette River and Ozette Lake and its tributaries in Washington have many of the water-quality and stream-hydraulic characteristics that are generally supportive of good sockeye salmon production. Ozette Lake is a large, deep lake and a natural rearing area and for young sockeye. In the summer of 1976 water temperatures preferred for the growth of young sockeye (45-68 degrees Fahrenheit) occurred between about 200 feet of depth and the water surface, or generally in the zone of steep temperature gradient. Dissolved-oxygen concentrations in excess of 8.0 milligrams per liter at all depths throughout the year provided an adequate supply of oxygen for sockeye production. In comparison with eight other sockeye-producing lakes in Washington and Alaska, the concentrations of zooplankton in Ozette Lake appear adequate to support the rearing of sockeye salmon. In Big River and Umbrella Creek, tributaries to Ozette Lake, the streambed areas with gravels suitable for spawning were calculated to be about 39,000 and 31,000 square yards, respectively. If those areas were completely utilized they would accomodate about 13,000 and 10,000 spawning sockeye females, respectively. (Woodard-USGS)
W79-09400

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

DIRECTORY OF LOCAL ASSISTANCE CENTERS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards.
Geological Survey open-file report 79-423, 1979. 10 p.

Descriptors: *Data storage and retrieval, *Information exchange, *Indexing, *Cooperatives, Assistance centers, Directory, U.S. Geological Survey, Water resources division, *National Water Data Exchange(NAWDEX).

The National Water Data Exchange (NAWDEX), managed by the U.S. Geological Survey, has established a network of Local Assistance Centers throughout the United States and Puerto Rico to assist users of water data in identifying and locating the data they need. This Directory provides the information needed to contact any of the established Centers. (Woodard-USGS)
W79-09406

10F. Preparation Of Reviews

SYMPOSIUM ON THE PHYSICS AND CHEMISTRY OF ICE,
For primary bibliographic entry see Field 2C.
W79-09342

THE DISTORTION OF A WATER MOLECULE IN ICE,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
For primary bibliographic entry see Field 1A.
W79-09343

CONFIGURATIONAL STATISTICS,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Physics.
For primary bibliographic entry see Field 2C.
W79-09348

THE CORE STRUCTURE AND THE MOBILITY OF DISLOCATIONS IN ICE,
Birmingham Univ. (England). Dept. of Physics.
For primary bibliographic entry see Field 2C.
W79-09368

STRUCTURE AND BEHAVIOUR OF GRAIN BOUNDARIES IN POLYCRYSTALLINE ICE,
Hokkaido Univ., Sapporo (Japan). Dept. of Applied Physics.
For primary bibliographic entry see Field 2C.
W79-09387

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 22
NOVEMBER 15, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 22
NOVEMBER 15, 1979

W79-09581 -- W79-09830

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use, Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface, Groundwater Management; Effects on Water of Man's Nonwater Activities, Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand, Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures, Hydraulics; Hydraulic Machinery; Soil Mechanics, Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing, Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

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ABSTRACT SOURCES

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

CHEMICAL ANALYSES OF GROUND WATER RELATED TO GEOTHERMAL INVESTIGATIONS IN THE TETON RIVER AREA, EASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
E. G. Crosthwaite.
Geological Survey open-file report 79-687, 1979. 14 p, 5 fig, 2 tab, 12 ref.

Descriptors: *Geothermal studies, *Groundwater, *Thermal water, *Water temperature, *Measurement, Methodology, Thermometers, Chemical analysis, Physical properties, Isotope studies, Geology, Aquifer characteristics, Cation thermometer.

Water samples from 31 wells and springs in eastern Idaho and western Wyoming were collected to help evaluate the potential geothermal resources in the Teton River area. Water analyses included anions and cations, oxygen-18, deuterium, and several minor elements. Actual temperature of the thermal waters ranged from 23 to 49C. Estimated aquifer temperatures, as derived from geochemical thermometers, ranged from 45 to 145C based on sodium-potassium-calcium ratios. Using the cation thermometer, two analyses indicated aquifer temperatures lower than actual measured temperatures. Using a mixing model method, estimated temperatures ranged from 205 to 320C, the higher being of questionable value. The different methods used showed little correlation. Based on isotope data, the warm waters may be of local meteoric origin and not heated enough to react significantly with aquifer rocks; or, they originated as precipitation at high altitude and great distance from the area. (Woodard-USGS)
W79-09741

1B. Aqueous Solutions and Suspensions

SALT EFFECTS ON THE HYDRAULIC CONDUCTIVITY OF A SANDY SOIL,
Agricultural Research Organization, Bet Dagan (Israel).
For primary bibliographic entry see Field 2G.
W79-09771

2. WATER CYCLE

2A. General

ELEMENT CYCLES AND WATER BUDGET ANALYSES APPLIED TO FOREST MANAGEMENT IN THE EASTERN UNITED STATES,
Oak Ridge National Lab., TN.
D. D. Huff, W. T. Swank, C. A. Troendle, G. S. Henderson, and J. B. Waide.
In: Proceedings of the 1978 Annual Meeting of the Society of American Foresters, October 23, 1978, St. Louis, Missouri, p 77-89. (1978) 8 fig, 9 tab, 26 ref.

Descriptors: *Nutrient cycling, *Hydrologic models, Nitrogen cycle, Simulation, Evapotranspiration, Water yield, *North Carolina, Tennessee.

Ecosystem science has made significant advances in the past several years that can provide information useful in the evaluation of environmental and resource management issues. Examination of nutrient budgets has shown that concentrations of all dissolved nutrients in stream discharge from watersheds altered by cutting, species conversions, and changes in land use remained low after manipulations. None of the treatments produced long-term elevated nutrient levels that would adversely affect water use. However, simulations suggest that elevated losses of NO3-N associated with harvesting may cause a significant decline in the nitrogen pool of the forest ecosystem. Furthermore, nitrogen depletion may increase with increasing time of management, and complete-tree harvest probably results in the greatest nitrogen depletions of any cutting alternative. (Forest Service)
W79-09719

FOUNDATION THEORIES OF SOLUTE TRANSPORT IN POROUS MEDIA: A CRITICAL REVIEW,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W79-09725

2B. Precipitation

APPLICATION OF A TWO-DIMENSIONAL CLOUD MODEL TO CLOUD SEEDING EXPERIMENTS,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
H. D. Orville, R. D. Farley, F. J. Kopp, J. H. Hirsch, and E. Hsie.
Final Report No. 79-4, April 1979. Prepared for the Office of Atmospheric Resources Management, Bureau of Reclamation. 95 p, 24 fig, 3 tab, 33 ref, 2 append. 5-07-DR-12100.

Descriptors: *Weather modification, *Mathematical models, Rainfall, Hail, Precipitation(Atmospheric), Cloud physics, Meteoric water, Ice, Snow, Miles City(Montana), Big Spring(Texas), Radiosondes, Meteorology.

A two-dimensional, time-dependent cumulus cloud model was developed and applied to convective cloud situations to simulate cloud seeding experiments. Both seeded and unseeded conditions were modeled with atmospheric soundings from Miles City, Montana, and Big Spring, Texas, to show quantitatively the differences in precipitation processes at the two sites. The model, a set of partial differential equations, expresses conservation of momentum, energy, air mass, and various water masses (rain, hail, cloud water, and cloud ice). The cloud-seeding agents used were dry ice and silver iodide. Results show that a 'first generation' model with dry ice seeding directly effects an increase in precipitating ice at the expense of supercooled cloud water and results in significantly more precipitation on the ground. A more realistic 'second generation' seeding model produces more precipitation if seeding is done early enough in the major updraft region. In this model the seeding agent field is traced throughout and interacts with the super-cooled cloud water to form cloud ice. (Seigler-IPA)
W79-09664

AIRBORNE STUDIES OF ATMOSPHERIC AEROSOL IN THE HIGH PLAINS AND THE STRUCTURES OF NATURAL AND ARTIFICIALLY SEEDED CLOUDS IN EASTERN MONTANA,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
P. V. Hobbs, M. K. Politovich, D. A. Bowdle, and L. F. Radke.
Contributions from the Cloud Physics Group, Research Report XIII, December 1978. 419 p, 111 fig, 33 tab, 74 ref, 4 append.

Descriptors: *Cloud seeding, *Aerosols, *Atmospheric physics, *Montana, Cloud physics, Precipitation(Atmospheric), Meteorology, Weather modification, Condensation, Nucleation, Ice, Rainfall intensity, Chemistry of precipitation, Silver iodide.

Atmospheric aerosol particles and the microstructures of natural and artificially seeded clouds were studied as part of the Bureau of Reclamation's High Plains Experiment (HIPLEX). Cloud structures, precipitation-producing mechanisms, and the potential for precipitation modification by various types of cloud seeding in southeast Montana were also studied. Findings on cloud condensation nuclei (CCN) show: (1) frequency distributions of the concentrations of CCN at 0.2, 0.5, 1.0, and 1.5% supersaturations were bimodel with approximately log-normal constituent distributions; (2) CCN concentrations at each supersaturation varied cyclically from day to day; (3) CCN concentrations at higher supersaturations tended to increase more rapidly and decrease more slowly than CCN at lower supersaturations; (4) three typical CCN spectra were identified (maritime, transitional, and aged continental); (5) CCN measurements on a given day were usually characterized by a single spectrum; and (6) the most reliable and useful method for determining CCN concentrations is by airborne measurements with real-time output. Measurements indicate that in the Miles City, Montana area, the artificial seeding of small cumulus clouds and embedded cumulus from cloud top with dry ice or Ag I may increase precipitation, but is unlikely that precipitation from cumulus complexes could be increased by seeding. (Seigler-IPA)
W79-09665

MESOSCALE STRUCTURE OF HAWAIIAN RAINSTORMS,
Hawaii Univ., Honolulu. Water Resources Research Center.
T. A. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 955, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 119, September 1978. 69 p, 33 fig, 10 plates, 8 tab, 43 ref, 2 append. OWRT A-072-HI(2). 14-34-0001-8013.

Descriptors: Meteorological satellites, Flash floods, Rainfall disposition, Hawaii, *Rainstorms.

Three significant Hawaiian rainstorms were analyzed using conventional meteorological data and photographs from the Synchronous Meteorological Satellite (SMS-2). The impact of the satellite on analysis and forecasting was evaluated. Gridding inaccuracies and the distinctive nature of Hawaiian rains limit the impact of the satellite to the scale of synoptic analysis. The storms studied illustrate the range of Hawaiian flood-producing systems and the limitations of the detection network. The most important meteorological determinant of flood location is the low-level wind direction. Forecast and detection capabilities are evaluated in terms of developments in the coterminus United States, and it is concluded that the absence of meteorological radar in Hawaii inhibits significant progress. Contingency indices (CI) were computed for 103 rain gages in the Hawaiian Islands. Results are presented in matrices of CI and in individual island maps on which CIs are plotted and analyzed relative to representative stations. The secondary CI maximum with increasing station separation, which has been attributed to spacing of convective updrafts, does not appear in Hawaiian examples. Orography dominates the CI patterns which resemble isohyets. The analysis was extended to interisland comparisons using representative windward and leeward stations. CIs decrease with distance in both samples but more so for windward (trade wind) stations.
W79-09673

2C. Snow, Ice, and Frost

APPLICATION OF NUMERICAL TRANSIENT FLUID DYNAMICS TO SNOW AVALANCHE FLOW. PART I. DEVELOPMENT OF COMPUTER PROGRAM AVALNCH,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
T. E. Lang, K. L. Dawson, and M. Martinelli, Jr.
Journal of Glaciology, Vol. 22, No. 86, p 107-115, 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Avalanches, *Snow, *Flow, *Model studies, Mathematical models, Computer models, Computer programs, Fluid mechanics, Friction, Viscosity, Analytical techniques, Simulation analysis, Snow avalanche flow, Transient fluid dynamics.

A two-dimensional, transient fluid-dynamics computer code has been modified for specific applica-

tion to the avalanche-runout problem. This code, called AVALNCH, permits the separation of path geometry effects from such flow factors as friction and viscosity. The longitudinal profile of the avalanche path is divided into cells, 10 to 20 m long, each of which can be assigned specific values for slope gradient, surface friction, and internal kinematic viscosity. The program gives average avalanche speed cell-by-cell down the path and the location and depth of avalanche debris. Internal kinematic viscosity and surface friction were modeled on an avalanche path of simple geometry and were found to be of about equal significance in predicting runout distance. Additionally, surface friction is represented by an exponentially increasing function as speed decreases in the runout zone, in order to model observed avalanche terminal-motion characteristics. Program AVALNCH is reduced to a basic algorithm that is efficient to run and contains the essential mechanics to model avalanche flow accurately. The most pressing need is for more physical data to permit the matching of program output to observed results under a variety of conditions. (See also W79-09747) (Sims-ISWS)
W79-09746

APPLICATION OF NUMERICAL TRANSIENT FLUID DYNAMICS TO SNOW AVALANCHE FLOW. PART II. AVALANCHE MODELING AND PARAMETER ERROR EVALUATION,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
T. E. Lang, and M. Martinelli, Jr.
Journal of Glaciology, Vol. 22, No. 86, p 117-126, 1979. 6 fig, 3 tab, 2 ref.

Descriptors: *Avalanches, *Snow, *Flow, *Model studies, Mathematical models, Computer models, Computer programs, Fluid mechanics, Analytical techniques, Simulation analysis, Friction, Viscosity, Slopes, On-site investigations, Snow avalanche flow, Transient fluid dynamics.

Under evaluation is the range of the parameters of internal viscosity and surface friction of flowing avalanches in order to represent the flow numerically by computer program AVALNCH. Nominal values of these parameters were determined to be in the range 0.4 to 0.6 for snow flowing on snow, with values as high as 0.8 to 0.9 for snow flowing on rough ground. Using a nominal avalanche path, the basic parameters: (1) depth of initial release slab, (2) viscosity and friction, (3) adverse grade, and (4) flow spreading were determined to be in the order listed as regards their relative effect on avalanche runout distance. Program AVALNCH, which permits treatment of flow parameters separately from geometric parameters, provides a versatile tool for the prediction of avalanche runout, as well as for related studies of avalanche dynamics. (See also W79-09746) (Sims-ISWS)
W79-09747

FLEXURAL WAVE STUDIES ON THE BASIS OF SINGLE-SENSOR RECORDINGS,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences; and Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
R. W. Taylor.
Journal of Glaciology, Vol. 22, No. 86, p 171-175, 1979. 4 fig, 1 tab, 10 ref. NSF KG-41011.

Descriptors: *Ice, *Lake ice, *Physical properties, On-site investigations, Elasticity(Mechanical), Elastic deformation, Youngs modulus, Data processing, Analytical techniques, Dispersion, Physics, *Flexural waves, Ice thickness, Phase velocity.

The method described here provides a means of measuring flexural-wave dispersion and attenuation appropriate to a selected area on the basis of single-sensor recordings made remote from the area of interest. The measured dispersion may then be inverted in the conventional manner to obtain thickness and elastic properties of the ice within the selected area. The procedure eliminates the need for equipment within the study area and minimizes the need for personnel within the area. As only a single sensor is necessary, the requirements for recording equipment and sensor cabling are also minimized. The method is suited to any study of flexural-wave dispersion from artificial sources and is ideally suited to the study of areas where personnel and equipment safety are a major concern. (Sims-ISWS)
W79-09760

DETERMINATION OF A-AXIS ORIENTATIONS OF POLYCRYSTALLINE ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
M. Matsuda.
Journal of Glaciology, Vol. 22, No. 86, p 165-169, 1979. 4 fig, 5 ref.

Descriptors: *Ice, *Crystals, *Glaciers, Laboratory tests, Instrumentation, Analytical techniques, Methodology, Optical properties, Measurement, Crystallography, Glaciology, Axis orientations, Polycrystalline ice.

Two new methods have been devised for measurement of crystallographic lattice orientations of individual crystals in polycrystalline ice. The first uses edge-length ratios of etch pits. The second uses a combination of optical measurement on a thin section and etch-pit technique. Although the second method does not work for crystals with their c-axis oriented parallel to the thin section, it is much simpler and more practical than the first method. When used on polycrystalline glacier ice, the second method gave the 3 a-axis orientations as well as c-axis orientation for each crystal with an accuracy of 5 deg. (Sims-ISWS)
W79-09761

ENTHALPY RELAXATION PHENOMENON OF HEAVY ICE,
Osaka Univ. (Japan). Dept. of Chemistry.
O. Haida, H. Suga, and S. Seki.
Journal of Glaciology, Vol. 22, No. 86, p 155-164, 1979. 4 fig, 3 tab, 25 ref.

Descriptors: *Ice, *Deuterium, *Thermal capacity, *Structural relaxation, Laboratory tests, Temperature, Crystals, Heavy water, Physical properties, Thermal properties, Physics, Enthalpy, Enthalpy relaxation, Heavy ice.

The heat capacities of quenched and annealed heavy ice, Ih, were measured in the temperature range 14 to 300 K by an adiabatic calorimeter. A relaxational thermal anomaly was found at around 115 K, and this phenomenon was ascribed to the onset of deuteron ordering in the crystal. The average activation enthalpy of the relaxational process was determined to be (26 + or - 5) kJ/mol. Residual entropies of the crystal were recalculated on the basis of the present heat-capacity data combined with the revised values for enthalpy of vaporization, saturated vapor pressure, and spectroscopic entropy. They were (3.47 + or - 0.41) J/K/mol for the quenched crystal and (3.44 + or - 0.41) J/K/mol for the crystal annealed at 102-106 K for 264 h. The characteristics and the origin of the anomaly were discussed in comparison with that of ordinary ice. (Sims-ISWS)
W79-09762

DIELECTRIC BEHAVIOUR OF ICE MICROCRYSTALS: A STUDY VERSUS TEMPERATURE,
Pau Univ. (France). Inst. Univ. de Recherche Scientifique.
C. Boned, B. Lagourette, and M. Clausse.
Journal of Glaciology, Vol. 22, No. 86, p 145-154, 1979. 6 fig, 2 tab, 43 ref.

Descriptors: *Ice, *Electrical properties, *Temperature, Laboratory tests, Measurement, Crystals, Aqueous solutions, Emulsions, Electrical studies, Melting, Ice microcrystals, Dielectric behaviours, Permittivity.

Dispersions of ice microcrystals were obtained from the breakdown of supercooling of water-in-oil type emulsions whose disperse phase was either resin-exchanged water or aqueous solutions of NH4Cl. Their complex permittivity was studied versus temperature T, up to the melting point of ice microcrystals, by means of an automatically balancing admittance bridge working at 400 Hz and 1 kHz. The plots revealed that these systems exhibit two distinct dielectric relaxations located on either side of a temperature, T sub m, which was found to be equal to about -20 C in the case of water and lower than -20 C in the case of aqueous solutions of NH4Cl. The relaxation located in the lower temperature range arose from the Debye dipolar absorption of ice, while the other one could be related to structural changes occurring within the lattice of ice as T approaches its melting point. These results were consistent with those obtained by investigating versus frequency the dielectric behavior of ice monocrystals at discrete sub-zero temperatures close to their melting point. (Sims-ISWS)
W79-09763

FRACTURE TOUGHNESS OF FRESH-WATER ICE,
Sheffield. (England). Dept. of Mechanical Engineering.
H. W. Liu, and K. J. Miller.
Journal of Glaciology, Vol. 22, No. 86, p 135-143, 1979. 4 fig, 3 tab, 19 ref.

Descriptors: *Ice, *Physical properties, *Cracks, Mechanics, Laboratory tests, Stress, Loads(Forces), Strength, Tensile strength, Temperature, Crystals, Physics, Freshwater, Ice strength.

The plane-strain fracture toughness of freshwater ice was measured at various loading rates and temperatures. The fracture toughness of ice decreases as loading rate increases and as the test temperature approaches the melting point. The presence of liquid water seems to reduce the fracture toughness. The fracture toughness for crack arrest is slightly lower than the static fracture toughness. (Sims-ISWS)
W79-09764

USING LINEAR DISCRIMINANT ANALYSIS TO CLASSIFY SNOWFALL SITUATIONS INTO AVALANCHING AND NON-AVALANCHING ONES,
Sredneaziatskii Nauchno-Issledovatelskii Gidrometeorologicheskii Inst., Tashkent (USSR).
N. F. Drozdovskaya.
Journal of Glaciology, Vol. 22, No. 86, p 127-133, 1979. 6 tab, 7 ref.

Descriptors: *Avalanches, *Snow, *Model studies, Mathematical models, Snowfall, Snow cover, Precipitation(Atmospheric), Temperature, Air temperature, Solar radiation, Humidity, Classification, Meteorology, Discriminant analysis.

The existing methods of predicting avalanche danger often do not meet users' demands because of the empiric character of the insufficient volume of information used. In such forecasts, the contribution of each individual parameter into the prognostic information is unknown, and this is very important when studying such an event as avalanche formation, which is conditioned by a complex interaction of numerous factors, including snow accumulation, snow thickness, and the conditions of its development. It is obvious that such problems can be successfully solved by statistical methods, and that explains the growing interest in numerical methods of avalanche forecasting. Problems of multi-dimensional observations arise in many scientific fields. The method suited for this problem is discriminant analysis, the purpose of which is to divide a multi-dimensional observation vector into predetermined classes. This study considered the prognostic (diagnostic) problems of fresh-snow avalanches released during snowfall or in the two days after it has ceased. The theoretical basis was a complex of statistical methods: correlation and dispersion analysis, 'sifting' for the choice of predictors' informative groups, construction of linear parametric discriminant functions, predictions based on training sample, and verification of discriminant functions based on independent material. (Sims-ISWS)
W79-09765

THE FORMATION AND COMPOSITION OF THE GAS CONTENT OF SEA ICE,
Akademiya Nauk SSSR, Moscow. Okeanograficheskaya Komissiya.
V. L. Tsurikov.
Journal of Glaciology, Vol. 22, No. 86, p 67-81, 1979. 2 fig, 4 tab, 18 ref.

Descriptors: *Sea ice, *Porosity, *Gases, *Model studies, Mathematical models, Nitrogen, Oxygen, Brines, Freezing, Pores, Bubbles, Ice, Freezing processes.

The different factors contributing to the formation of the gas porosity of sea ice are: (1) gases captured during the formation of the initial ice cover, (2) gases released from solution during the initial freezing of sea-water, (3) the inclusion of gases rising from the sea bottom, (4) the substitution of gas for brine drained from the ice during times of melting, (5) the release of gas from the brine within the ice during the course of partial freezing, and (6) the formation of voids filled with water vapor during the course of internal melting. An analysis was made of each of these processes, and it was concluded that processes 1, 4, and 6, are important. Process 3 may also be a major effect, but it is difficult to evaluate until the rate of gas release from the sea floor is better known. The migration of air pockets into the ice from the overlying snow was shown to be a possible but not a significant effect. Available data on the composition of gas in sea ice were reviewed, and it was shown to be significantly different from air. Possible causes for these differences were discussed. (Sims-ISWS)
W79-09766

ACCUMULATION, ABLATION, AND OXYGEN ISOTOPE VARIATIONS ON THE QUEEN ELIZABETH ISLANDS ICE CAPS, CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Polar Continental Shelf Project.
R. M. Koerner.
Journal of Glaciology, Vol. 22, No. 86, p 25-41, 1979. 8 fig, 4 tab, 28 ref.

Descriptors: *Glaciers, *Ice cover, *Arctic, Isotope studies, Ablation, Growth rates, Fluctuations, Measurement, On-site investigations, Data processing, Oxygen, Oxygen isotopes, Freezing, Melting, Snow, Glaciology, Islands, *Queen Elizabeth Islands, Ice caps.

Measurements made on traverses over ice caps in the Queen Elizabeth Islands showed that there is a region of very high accumulation (greater than 40 g/sq cm/yr) on the slopes facing Baffin Bay and one of low accumulation (less than 15 g/sq cm/yr) in the interior parts of northern Ellesmere Island. Ablation rates in summer show much less regional variation over the same ice caps, except for lower rates along the northwest edge of the islands and possibly on the Baffin Bay slopes as well. However, there is a stronger relationship between ablation and elevation which is exponential below the firn line. From the fractional 018 content of the snow it was shown that Baffin Bay contributes significant amounts of moisture (more than 20% of the total) to the Baffin Bay slopes. In addition, the Arctic Ocean was seen as another, but much less significant, moisture source. The delta 018 data showed two effects on the condensation processes--an orographic one (i.e., adiabatic cooling) and a distance-from-source effect (isobaric cooling) where the source is somewhere to the southeast of the islands. (Sims-ISWS)
W79-09767

DIRECT MEASUREMENT OF STRESS AT THE BASE OF A GLACIER,
University of East Anglia, Norwich (England). School of Environmental Sciences.
G. S. Boulton, E. M. Morris, A. A. Armstrong, and A. Thomas.
Journal of Glaciology, Vol. 22, No. 86, p 3-24, 1979. 17 fig, 1 tab, 14 ref.

Descriptors: *Glaciers, *Stress, *Measurement, *On-site investigations, Pressure, Shear stress, Rocks, Ice, Fluctuations, Data processing, Alpine, Cavitation, Pressure, Loads(Forces), Glaciology, *Glacier d'Argentiere(France), *France.

Contact stress transducers were placed in subglacial bedrock and were used to monitor continuously shear stress and normal pressure changes at the contact with the overriding glacier sole 100 m beneath the surface of the Glacier d'Argentiere during periods in summer 1973 and spring 1975. The measured fluctuations in normal pressure and shear stress do not appear to be related to changes in sliding velocity. Analysis of the data revealed short-term fluctuations in normal pressure and shear stress which appear to be related to the passage of individual large debris particles or groups of particles over the transducer. The shear stress appears to be a function of the volume concentration of debris in the ice. The volume concentration at any point appears to be partially dependent on a 'streaming' process by which basal debris-rich ice tends to flow around the lateral flanks of hummocks on the glacier bed. Where subglacial cavities occur, this streaming effect appears to be dependent on the extent of cavitation and thus on ice overburden pressure and velocity. It was suggested that this process can account for an apparent lag between changes in normal pressure and shear stress. (Sims-ISWS)
W79-09768

2E. Streamflow and Runoff

LANDSCAPE EVOLUTION, PEATLAND TYPES, AND THE ENVIRONMENT IN THE LAKE AGASSIZ PEATLANDS NATURAL AREA, MINNESOTA,
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 2I.
W79-09644

BRIEF DESCRIPTION OF THE SHOALS IN THE KREMENCHUG RESERVOIR AND THEIR PLANT COVERS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 2I.
W79-09645

HYDRAULICS OF THE ATCHAFALAYA BASIN MAIN CHANNEL SYSTEM CONSIDERATIONS FROM A MULTIUSE MANAGEMENT STANDPOINT,
Coastal Environments, Inc., Baton Rouge, LA.
J. L. van Beek.
Report No. EPA-600/4-79-036, May 1979. Environmental Monitoring Series. 41 p, 11 fig, 3 tab, 5 ref, 1 append.

Descriptors: *Water resources development, *Flood plains, *Atchafalaya River(Louisiana), *Flood control, Sediment load, Discharge measurement, Channel flow, Hydraulics, Mississippi River, Alluvial fans, Banks, Dredging, Levees.

The Atchafalaya Basin, a large alluvial basin in south-central Louisiana was studied in terms of discharge regime, sediment load, channel form and size, flood control, water surface slope, bank elevation, overbank capacity, dredging requirements, and spoil disposal. The basin has national significance as a multiple resource because it posseses high quality habitats for fish and wildlife, is a semiwilderness of high recreational value, and functions as a floodway for the lower Mississippi River. Channel training or channelization modifications are being considered to meet the need for flood control. Hydraulic characteristics of the present main channel are analyzed and the rate of natural channel development along the main channel is presented with the net change in channel cross-sectional area from changes in bed and flow line. Results indicate that: (1) use of the basin for flood control must be within the constraints imposed by the Atchafalaya River, (2) additional flood control capacity can only be acquired by raising guide levees, (3) flow confinement should be through training levees of material dredged from the main channel, and (4) flow confinement should only be to the extent allowed by annual flooding requirements. Various alternative designs for flood control are also discussed. (Seigler-IPA)
W79-09662

HUMAN DIMENSIONS OF THE FLOOD HAZARD,
University of Strathelyde, Glasgow (Scotland).
K. Smith.
Water, Journal of the National Water Council, London, No. 27, p 7-10, July 1979. 6 fig, 5 ref.

Descriptors: *Social aspects, *Flood plains, *Flood control, *Great Britain, Flood forecasting, Levees, Design floods, Flood damage, Flood plain zoning, Flood protection, Warning systems, Channel improvement, Land use, Urbanization, Reservoirs.

Measures to reduce the hazard potential from flooding in Great Britain are discussed. Methods currently available to the water industry are only partially effective due to the concentration on engineering or technical solutions and neglecting alternative measures. In particular, the fundamental public behavioral aspects of the problem have been virtually ignored. In Great Britain as in most other countries, the major response to flood threats has been the construction of works (embankments, levees, channel enlargments, reservoirs, and artificial relief channels) to contain and control rivers without inundating large areas of their flood plains. Unfortunately, the construction of these works generates the belief that the land protected by the structure represents absolute safety where the flood hazard has been eliminated. This encourages urban development in these areas and puts more property at risk to major flooding than before the works were constructed. In theory this problem can be prevented by firm land use regulations. However, since compliance to regulations is mostly voluntary and real estate value increases near rivers, land use regulations have not been an adequate safeguard. Flood forecasting has greatly improved due to advances in telemetry, computer modelling, and remote sensing of rainfall by radar. Despite these improvements in forecasting, little has been done to inform the public of forecast and warning programs. (Seigler-IPA)
W79-09670

MAGNITUDE AND FREQUENCY OF FLOODS IN WESTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
D. D. Harris, L. L. Hubbard, and L. E. Hubbard.
Geological Survey open-file report 79-553, 1979. 35 p, 3 fig, 2 plates, 4 tab, 25 ref.

Descriptors: *Flood frequency, *Oregon, *Peak discharge, *Natural flow, *Flood forecasting, Analytical techniques, Gaging stations, Equations, Basins, Regional analysis, *Western Oregon, Coast, Willamette, Rogue-Umpqua, High Cascades, Log Pearson type III.

A method for estimating the magnitude and frequency of floods is presented for unregulated streams in western Oregon. Equations relating flood magnitude to basin characteristics were developed for exceedance probabilities of 0.5 to 0.01 (2- to 100-year recurrence intervals). Separate equations are presented for four regions: Coast, Willamette, Rogue-Umpqua, and High Cascades. Also presented are values of flood discharges for selected exceedance probabilities and of basin characteristics for all gaging stations used in the analysis. Included are data for 230 stations in Oregon, 6 stations in southwestern Washington, and 3 stations in northwestern California. Drainage areas used in the analysis range from 0.21 to 7,280 square miles. Also included are maximum discharges for all western Oregon stations used in the analysis. (Woodard-USGS)
W79-09736

DIRECT MEASUREMENTS OF SECONDARY CURRENTS AT A RIVER INFLEXION POINT,
University of East Anglia, Norwich (England). School of Environmental Sciences.
C. R. Thorne, and R. D. Hey.
Nature, Vol. 280, No. 5719, p 226-228, July 19, 1979. 4 fig, 16 ref.

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Field 2—WATER CYCLE

Group 2E—Streamflow and Runoff

Descriptors: *Currents(Water), *Rivers, *On-site investigations, *River flow, Flow, Open channels, Measurement, On-site data collections, Instrumentation, Methodology, Analysis, Foreign research, Hydraulics, *Secondary currents, Inflection point, River bends.

To investigate the pattern of secondary flow between bends in a river, data were collected at Penstrowed, Powys, on the River Severn, using an electromagnetic flow meter. This instrument measures velocity in two perpendicular directions simultaneously with an accuracy of 10 mm/s. Measurements were made at three sections across the river between two meander bends. The meter was positioned to measure long and cross-stream velocity. The secondary flow pattern at the bend exit is dominated by the skew-induced cell from the upstream bend. There seems to be a rather weak outer bank cell near the right hand bank. The data for section 3 at the entrance to the downstream bend indicated that this is not the case for a series of bends. Here, a skew-induced cell of opposite rotation to that in the upstream bend dominates the secondary flow pattern. Section 2 at the inflexion point, seems to show a two cell system with vertical stacking in the central part of the channel. The upper cell is the relic skew-induced cell from the upstream bend, while the lower cell is the developing skew-induced cell for the downstream bend. Direct measurements of secondary currents at a river inflexion point confirmed that the system of cell development proposed by Chacinski and Francis can operate in rivers as well as uniform flume channels. An important difference is that the bed topography in a natural stream seems to result in early and more complete replacement of remnant cells from an upstream bend. (Humphreys-ISWS)
W79-09752

VARIATION OF MANNING'S N ROUGHNESS COEFFICIENT WITH FLOW IN OPEN RIVER CHANNELS,
Forth River Purification Board, Edinburgh (Scotland).
R. J. Sargent.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 3, p 290-294, May 1979. 1 fig, 3 tab, 3 ref.

Descriptors: *Mannings equation, *Rivers, *Roughness(Hydraulic), *On-site investigations, Foreign research, Discharge(Water), Data collections, On-site tests, Open channel flow, Analytical techniques, *Scotland, Mannings n.

Survey data were obtained for a number of open river channels in order to accurately determine channel geometry. The channel sections chosen were at established river gaging stations, enabling an accurate estimate of river discharge to be made. These two sets of data were combined using Manning's equation, modified for multi-sectional open river channels to obtain estimates of Manning's n. This procedure was repeated at each station over a wide range of flows to study the effect of varying channel discharge on the roughness coefficient. As discharge increased, Manning's n was found to decrease rapidly, approaching an asymptotic value as bankful discharge was approached. The significance of this variation was discussed, and it was suggested that the asymptotic value of n may be used to extend the gaging station calibration beyond the highest gaged flow. (Humphrey-ISWS)
W79-09754

SHAPE EFFECTS ON RESISTANCE TO UNIFORM FLOW IN OPEN CHANNELS,
Queensland Univ., Brisbane (Australia). Hydraulic Engineering.
A. K. Kazemipour, and C. J. Apelt.
Journal of Hydraulic Research, Vol. 17, No. 2, p 129-147, 1979. 8 fig, 24 ref.

Descriptors: *Resistance, *Open channels, *Uniform flow, Shape, Cross-sections, Flow resistance, Hydraulics, Equations, Open channel flow, Mathematical studies, *Shape effects, Smooth turbulent flow.

A new method for dealing with shape effect was developed in this paper from considerations of dimensional analysis and using the experimental data of Tracy and Lester and of Shih and Grigg. This method, which is referred to as Kazemipour's method, employs new parameters more representative of the effect of cross-sectional shape on flow resistance in open channels than those previously used and offers solutions more rational than those previously proposed. A shape factor reflecting the effects of non-uniform distribution of shear stress on the boundary as the shape of cross section departs from an infinitely wide rectangle and a width/average depth, or aspect ratio of the cross section were developed. It was demonstrated that application of this shape factor shifts the experimental data for open channel resistance on to the universal diagrams for flow resistance in circular pipes for a variety of cases. The shape factor establishes a simple correlation between open channel and pipe flow and permits the universal resistance diagrams and formulas available for pipe flow to be used to calculate the friction factor and average velocity in open channel flow. The effectiveness of the method has been demonstrated for smooth turbulent flow in rectangular, triangular and trapezoidal cross sections, and for rough and transitional turbulent flow in rectangular cross sections. This suggests that its applicability may be much wider. (Lee-ISWS)
W79-09757

RESISTANCE TO FLOW IN ALLUVIAL CHANNELS WITH COARSE BED MATERIALS,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowa (Poland).
For primary bibliographic entry see Field 2J.
W79-09758

VELOCITY MEASUREMENTS DOWNSTREAM OF REARWARD-FACING STEPS, WITH REFERENCE TO BED INSTABILITY,
D. W. Etheridge, and P. H. Kemp.
Journal of Hydraulic Research, Vol. 17, No. 2, p 107-119, 1979. 8 fig, 1 tab, 7 ref.

Descriptors: *Velocity, *Beds, *Measurement, *Downstream, Bubbles, Shear stress, Hydrodynamics, Boundary layer, Hydraulics, Waves(Water), Flow, *Rearward-facing steps, Bed stability, Separation bubbles, Length of separation, Velocity measurement.

Velocity measurements close to a smooth bed have been made downstream of a range of rearward-facing steps. When the step height is greater than the thickness of the viscous sublayer, the effect of the step on velocities close to the bed is large and is apparent for 30 step heights and more in the downstream direction. The dimensionless mean velocity fluctuation tends toward a constant value, however, within about 10 step heights. Large fluctuations in the instantaneous length of the separation bubble occur. The extent to which the instantaneous shear stress would exceed the critical shear stress for initial movement of a given sand is relevant to the formation and propagation of ripples. (Lee-ISWS)
W79-09759

2F. Groundwater

ESTIMATING WETLAND WATER LEVELS,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6A.
W79-09587

THE ROLE OF HYDROLOGY IN FRESHWATER WETLAND ECOSYSTEMS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 21.
W79-09614

FLOW NEAR THE OUTLET OF A GEOTHERMAL ENERGY RESERVOIR,
Los Alamos Scientific Lab., NM.
H. D. Murphy.
Report No. LA-7906-7, UC-66a, July 1979. Doctoral thesis, Arizona Univ. 272 p, 39 fig, 14 tab, 90 ref. W-7405-ENG.36.

Descriptors: *Geothermal studies, *Flow characteristics, *Flow profiles, Mathematical models, Turbulent flow, Water circulation, Laminar flow, Reynolds number, Transition flow, Energy conversion, Reservoirs, Rock mechanics, Water pressure.

Numerical and experimental investigations are presented for a steady, incompressible flow converging radially between two stationary parallel plates. This situation is applicable to the mechanics of water flow in the extraction of energy from dry hot rock geothermal energy reservoirs. The basic extraction process involves injecting cold water down to a freshly exposed hot rock surface and then returning the hot water to the surface where the energy is extracted. Characteristics of the flow near the outlet, where the rather large flow rate required to produce significant levels of power extraction is constrained to a smaller and smaller flow area cause large pressure losses. In some cases the flow near the outlet may become turbulent producing even greater pressure losses and degrading the efficiency of the system. Flow ranges investigated were laminar, turbulent, and transitional. Laminar flow experiments were conducted in a circular disk geometry over the half-spacing range 0.46 to 25.5mm with an overall Reynolds number range of 4000 to 106,000. Measured pressure drops were in good agreement with laminar predictions. Turbulent flows were examined with a pre-shaped apparatus with a fixed space of 12mm. For fully tabulated flow, reasonably good agreement with measured pressures and wall shear stresses was obtained with numerical predictions. Data are also presented on laminarizing flows and reduction of turbulent fluctuations. (Seigler-IPA)
W79-09667

ROLE OF THE BLUE-GREEN ALGA NOSTOC MUSCORUM AS A POSSIBLE NITRATE SOURCE TO THE GROUNDWATERS OF GUAM,
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W79-09676

DETERMINATION OF HYDROLOGIC PARAMETERS FOR GLACIAL TILLS IN CONNECTICUT,
Connecticut Univ., Storrs.
L. J. Torak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 313, Price codes: A08 in paper copy, A01 in microfiche. M.S. Thesis, 1979. 161 p, 9 tab, 30 fig, 33 ref, 9 append. OWRT A-077-CONN(1). 14-34-0001-9007.

Descriptors: Hydrologic properties, *Glacial soils, Waste disposal, Aquifer characteristics, *Computer models, Laboratory tests, Dug wells, Glacial tills, Till aquifer, Anisotropic flow.

Glacial tills located in the upland areas of the Shetucket and Quinebaug River basins, Connecticut, were evaluated for horizontal permeability using field and laboratory techniques. A comparison of laboratory-determined, vertical permeabilities (Randall et. at., 1966) to horizontal permeabilities derived in this study from both laboratory and dug-well tests, revealed that the till exhibits anisotropic-flow characteristics similar to most stratified sediments. Horizontal components of permeability of at least an order of magnitude greater than vertical components are shown to exist for the glaciat tills in this area. The hydrologic implications that arise from considering the anisotropy of the tills in this study area may have regional applications to similar tills located throughout New England. A computer-model simulation utilizing the permeability contrasts and ansisotropic nature of the till and mixed-zone material was performed to determine what effect these variations have on contaminant transport through a till aquifer Large variations of contaminant transport existed in the

hypothetical aquifers when an average horizontal permeability is assumed for the till rather than accounting for high-permeability layers that might exist. Computer-model simulations of waste movement through a till aquifer, such as those presented in this study, have widespread application relative to the design of sanitary landfills and other forms of waste disposal in till and stratified sediments. (deLara-Conn)
W79-09677

GEOHYDROLOGIC IMPACTS OF COAL DEVELOPMENT IN THE NARRAGANSETT BASIN, MASSACHUSETTS AND RHODE ISLAND,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-09731

GROUND-WATER BASIC DATA FOR MCINTOSH COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
R. L. Klausing.
North Dakota County Ground-Water Studies 30--Part II, and North Dakota Geological Survey Bulletin 73--Part II, 1979. 458 p, 2 fig, 1 plate, 6 tab, 17 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Hydrogeology, *Water quality, *Groundwater availability, Water wells, Well data, Drillers logs, Water levels, Water analysis, Chemical analysis, Water supply, Water utilization, North Dakota, *McIntosh County(N Dak).

Ground-water data for McIntosh County, N Dak., include: (1) Geologic and hydrologic records for 747 wells, test holes, and surface-water sites; (2) water-level measurements in 105 observation wells; (3) lithologic and geophysical logs of 497 test holes and wells; (4) chemical analyses of 185 groundwater samples; (5) chemical analyses of water from 4 selected lakes; and (6) chemical analyses of minor elements of water from 3 municipal wells. The purpose of the investigation was to determine the availability and quality of ground water for municipal, domestic, livestock, industrial, and irrigation uses. (Woodard-USGS)
W79-09737

SIMULATION ANALYSIS OF THE UNCONFINED AQUIFER, RAFT RIVER GEOTHERMAL AREA, IDAHO-UTAH,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-09739

GROUND-WATER RESOURCES OF DUNN COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
R. L. Klausing.
North Dakota County Ground-Water Studies 25--Part III, and North Dakota Geological Survey Bulletin 68--Part III, 1919. 48 p, 15 fig, 4 plates, 3 tab, 43 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Hydrogeology, *Water quality, *Groundwater availability, Water yield, Water level fluctuations, Water utilization, Maps, Water analysis, Chemical analysis, *Dunn County(N Dak).

Ground water in Dunn County, N. Dak., is obtainable from aquifers in the preglacial rocks and from aquifers in the glacial drift. The aquifers in the preglacial rocks have a greater areal distribution than those in the glacial drift, but those in the drift provide higher yields to individual wells. Aquifers in the preglacial rocks occur in the Fox Hills and Hell Creek Formations of Cretaceous age and in the undifferentiated Cannonball-Ludlow, Tongue River, and Sentinel Butte Formations of Tertiary age. These aquifers will yield from 1 to 200 gallons per minute. The water from these aquifers is predominantly soft and is a sodium bicarbonate type. The Killdeer, Knife River, and Goodman Creek aquifers in the glacial drift are capable of yielding water at rates of as much as 1,000 gallons per minute. The Horse Nose Butte aquifer will yield water at rates of as much as 500 gallons per minute. Water from these aquifers is hard to very hard and is predominantly a sodium bicarbonate type. (Woodard-USGS)
W79-09740

TRANSPORT MODELING IN THE ENVIRONMENT USING THE DISCRETE-PARCEL-RANDOM-WALK APPROACH,
Battelle Pacific Northwest Labs., Richland, WA.
S. W. Ahlstrom, and H. P. Foote.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWLSA-5528, Price codes: A02 in paper copy, A01 in microfiche. Presented at the Environmental Protection Agency Conference on Water Quality Modeling, Cincinnati, Ohio, April 20-22, 1976. 4 p, 4 fig, 3 ref. ERDA E(45-11): 1830.

Descriptors: *Dispersion, *Diffusion, *Solutes, *Mathematical models, *Pollutants, Oil spills, Sinks, Environment, Energy, Model studies, Water pollution, Lagrangian scheme, Random walk model.

A transport model was proposed to describe the movement of discrete parcels of mass and energy in the environment. The model was called Discrete-Parcel-Random-Walk (DPRW) Transport model. Each parcel in this model had a set of spatial coordinates as well as a set of discrete quantities of mass and energy. Each parcel's movement was assumed to be independent of any other parcel in the system. A Lagrangian scheme was used for computing the parcel advection, and a Markov random walk concept was used for simulating the parcel diffusion and dispersion. The DPRW technique is not subject to numerical dispersion and it can be applied to three-dimensional cases with only a linear increase in computation time. A wide variety of complex source/sink terms can be included in the model with relative ease. Examples of the model's application in the areas of oil spill drift forecasting, coastal power plant effluent analysis, and solute transport in groundwater systems were presented. (Bhowmik-ISWS)
W79-09750

2G. Water In Soils

WETLAND SOILS OF THE UPPER MIDWEST,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
G. B. Lee.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 12-23, (1978) 7 fig, 7 ref.

Descriptors: *Soils, *Hydrosols, *Wetlands, *Central US, Freshwater, Nutrients, Agriculture, Peats, Drainage.

Soils on a single hillside and adjacent valley in southern Wisconsin may vary widely in their degree of wetness. Each soil type possesses distinctive morphological characteristics that relate to the moisture regime(s) under which it formed. On the basis of such characteristics, soils may be grouped into natural drainage classes. Similar soils in each drainage class tend to support similar vegetation in their natural state and in many cases occupy similar landscape positions. In their natural state, wetland soils trap sediments, nutrients and pesticides, serve as temporary flood water storage areas and provide habitat for wildlife. Extremely productive agricultural land may be formed from some wetland soils by installing artificial drainage systems. (See also W79-09581) (Stihler-Mass)
W79-09582

CONSOLIDATION OF PORTAGE PEAT,
Wisconsin Univ.-Madison.
T. B. Edil, and A. W. Dhowian.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 24-37. (1978) 5 fig, 1 tab, 12 ref.

Descriptors: *Consolidation, *Settlement, *Peats, *Soil mechanics, Subsidence, Loads, Mechanical properties, Pressure, Wisconsin.

Consolidation tests conducted on Portage peat indicate that settlement is a continuing process and that it does not cease by the dissipation of pore pressure (primary consolidation) but rather a substantial amount of settlement takes place afterwards. This implies that the field settlements will continue for an extremely long period of time (on the order of 7 to 8 months in laboratory tests). The vertical strain after primary consolidation does not follow a straight line on the semilogarithmic settlement-time curve as concluded by many investigators. The compression index of Portage peat is roughly 5 to 10 fold higher than that of a typical inorganic soil's. (See also W79-09581) (Stihler-Mass)
W79-09583

ESTIMATING WETLAND WATER LEVELS,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6A.
W79-09587

EFFECTS OF FORMICA CINEREA ON A WETLAND SOIL ON WEST BLUE MOUND, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Soil Science.
J. L. Denning, F. D. Hole, and J. Bouma.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 276-287, 1978, 4 fig, 2 tab, 16 ref.

Descriptors: *Insects, *Soils, *Wetlands, *Effects, Organic matter, Phosphorus, Potassium, Calcium, Magnesium, Permeability, Wisconsin, Ants.

Influence of activity of the ant, Formica cinerea, on the profile of a clayey wetland soil (Typic Haplaquoll) was studied by comparing a profile at a mound site with an adjacent intermound profile in a wet meadow 2.6 ha in area in the midst of an oak (Quercus sp.) forest. By construction of a mound with a network of channels the ants have changed the saturated hydraulic conductivity of the soil from that of a normal clay soil to that of a gravel. Crusting during a rainstorm partially seals over the mound, thus giving additional protection of the nest from flooding from above. The soil of the mound contained less organic matter, but more available phosphorus, potassium, calcium and magnesium than did the intermound soil. (See also W79-09581) (Stihler-Mass)
W79-09603

LANDSCAPE EVOLUTION, PEATLAND TYPES, AND THE ENVIRONMENT IN THE LAKE AGASSIZ PEATLANDS NATURAL AREA, MINNESOTA,
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 2I.
W79-09644

FOUNDATION THEORIES OF SOLUTE TRANSPORT IN POROUS MEDIA: A CRITICAL REVIEW,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. Sposito, V. K. Gupta, and R. N. Bhattacharya.
Advances in Water Resources, Vol. 2, June 1979. 10 p, 1 tab, 39 ref. OWRT B-046-ARIZ(9), 14-34-0001-6057.

Descriptors: Markov processes, *Porous media, *Soil water movement, Hydrology, Solute transport, Brownian motion.

The theories that have been employed to derive the macroscopic differential equations that de-

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scribe solute transport through porous media are reviewed critically. These foundational theories may be grouped into three classes: (1) those based in fluid mechanics, (2) those based in kinematic approaches employing the mathematics of the theory of Markov processes, and (3) those based in a formal analogy between statistical thermodynamics and hydrodynamic dispersion. It is shown that the theories of class 1 have had to employ highly artificial models of a porous medium in order to produce a well-defined velocity field in the pore space that can be analysed rigorously or have had to assume that well-defined solutions of the equations of fluid mechanics exist in the pore space of a natural porous medium and then adopt an ad hoc definition of the solute diffusivity tensor. The theories of class 2 do not require the validity of fluid mechanics but they suffer from the absence of a firm dynamical basis, at the molecular level, for the stochastic properties they attribute to the velocity of a solute molecule, or they ignore dynamics altogether and make kinematic assumptions directly on the position process of a solute molecule. The theories of class 3 have been purely formal in nature, with an unclear physical content, or have been no different in content from empirically based theories that make use of the analogy between heat and matter flow at the macroscopic level. It is concluded that none of the existing foundational theories has yet achieved the objectives of: (1) deriving, in a physically meaningful and mathematically rigorous fashion, the macroscopic differential equations of solute transport theory, and (2) elucidating the structure of the empirical coefficients appearing in these equations.
W79-09725

SOLUTE DISPERSION IN UNSATURATED HETEROGENEOUS SOIL AT FIELD SCALE: I. THEORY,
Agricultural Research Organization, Bet Dagan (Israel).
G. Dagan, and E. Bresler.
Soil Science Society of America Journal, Vol. 43, No. 3, p 461-467, May-June 1979. 3 fig, 17 ref, 1 append.

Descriptors: *Theoretical analysis, *Unsaturated flow, *Heterogeneity, *Infiltration, *Dispersion, *Solutes, Hydrodynamics, Porous media, Hydraulic conductivity, Recharge, Equations, Soil physics, *Solute transport, Convective dispersion equation, Statistical properties.

In a heterogenous field whose hydraulic properties vary from point to point, the transport of solute also differs from profile to profile. In this paper, solute concentration on the field scale was treated as a random variable. The field heterogeneity was described in terms of the statistical distribution of the hydraulic parameters, which implies a corresponding distribution of the concentration. Equations for computing this distribution, as well as its average and variance, in a heterogeneous field were derived explicitly for a simple, but representative case, of leaching under random recharge distribution on the surface. The water and solute flow in unsaturated soil was assumed to be vertical and steady. The randomness of the hydraulic properties was reduced to that of the saturated hydraulic conductivity by adopting a scaling hypothesis and a log normal distribution. (See also W79-09749) (Adams-ISWS)
W79-09748

SOLUTE DISPERSION IN UNSATURATED HETEROGENEOUS SOIL AT FIELD SCALE: II. APPLICATIONS,
Agricultural Research Organization, Bet Dagan (Israel).
E. Bresler, and G. Dagan.
Soil Science Society of America Journal, Vol. 43, No. 3, p 467-472, May-June 1979. 4 fig, 1 tab, 7 ref.

Descriptors: *Unsaturated flow, *Heterogeneity, *Infiltration, *Dispersion, *Solutes, Hydrodynamics, Porous media, Hydraulic conductivity, Recharge, Soil physics, Leaching, Soil contamination, *Solute transport, Convective diffusion equation, Statistical properties.

A model for nonadsorbed solute spread by vertical steady-state flow of water in a heterogeneous field soil is applied to a Panoche soil with properties which have been investigated previously. Average solute concentration profiles as functions of depth and time are computed for various surface rates of infiltration. The average concentration over a layer extending from the soil surface to a given depth is also computed. It is shown that the concentration profile extends over an apparent mixing zone which is much larger than that predicted by a conventional convective diffusion equation in a fictitious homogeneous field, and that the latter lacks practical significance for prediction of solute spread in the field. The implications of the results for the leaching of saline field soil and crop yield estimates as they are influenced by rate of surface recharge and its uniformity are also discussed. (See also W79-09748) (Adams-ISWS)
W79-09749

FACTORS AFFECTING NITRATE NITROGEN AND CHLORIDE LEACHING VARIABILITY IN A FIELD PLOT,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
D. R. Cameron, C. G. Kowalenko, and C. A. Campbell.
Soil Science Society of America Journal, Vol. 43, No. 3, p 455-460, May-June 1979. 6 fig, 3 tab, 12 ref.

Descriptors: *Leaching, *Nitrogen, *Chlorides, *On-site tests, *Canada, Nitrates, Fertilizers, Salinity, Precipitation(Atmospheric), Infiltration, Movement, Sampling, Analytical techniques, Variability.

Nitrate nitrogen and chloride concentrations were monitored in a 3-year field study in order to examine factors affecting their variability. Fertilized and control plots, established each year, were sampled at least 8 times throughout the year by removing about 6-replicate soil cores for individual analyses each sampling time. It was found that non-uniform fertilization application accounted for 38 to 100% of the sampling variability immediately after fertilization. In fall and spring, differential rates of leaching of N03-N and Cl appeared to contribute significantly to variability increasing C.V.'s from about 40% to over 100%. Field and model results showed that differential leaching patterns could be attributed to 2 main factors: (1) variability of physical properties that determine water storage and transport, and (2) point differences in redistribution of incoming rain (runoff) due to differences in surface microrelief. (Humphreys-ISWS)
W79-09770

SALT EFFECTS ON THE HYDRAULIC CONDUCTIVITY OF A SANDY SOIL,
Agricultural Research Organization, Bet Dagan (Israel).
H. Pupisky, and I. Shainberg.
Soil Science Society of America Journal, Vol. 43, No. 3, p 429-433, May-June 1979. 7 fig, 11 ref.

Descriptors: *Hydraulic conductivity, *Soil physical properties, *Saline water, Percolation, Expansive clays, Dispersion, Pores, Alakline soils, Soil texture, Ion exchange, Piezometers, Instrumentation, Sodium adsorption ratio, Hydraulic head.

The changes in the hydraulic conductivity of a Red Brown sandy soil as a function of the concentration and SAR of the percolating solutions were measured. Also, the changes in the hydraulic heads along the soil column and analysis of the salt and clay concentrations in the effluent solutions were recorded. The data showed that at high ESP's and at salt concentration above 0.01N, swelling of the clay is the main mechanism responsible for hydraulic conductivity decrease. At low ESP and very dilute soil solutions, dispersion and clay migration into the conducting pores are the main mechanisms responsible for plugging the soil pores. Dispersion of the clay particles is possible only when the concentration of the soil solution drops below a threshold concentration at which the clay platelets flocculate. Dispersion of the clay may lead also to an increase in hydraulic conductivity when a sandy soil is leached with distilled water. (Visocky-ISWS)
W79-09771

2H. Lakes

WETLANDS FORMATION: SPATIAL MODELING OF LAKE-EDGE WETLANDS DEVELOPMENT,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6A.
W79-09599

THE USE OF MODELS TO STUDY WETLAND REGULATION OF NUTRIENT LOADING TO LAKE MENDOTA,
Wisconsin Univ.-Madison. Dept. of Botany.
For primary bibliographic entry see Field 6A.
W79-09600

GREEN BAY'S COASTAL WETLANDS--A PICTURE OF DYNAMIC CHANGE,
Wisconsin Univ.-Green Bay.
For primary bibliographic entry see Field 2I.
W79-09607

FRESHWATER WETLANDS: ECOLOGICAL PROCESSES AND MANAGEMENT POTENTIAL.
For primary bibliographic entry see Field 2I.
W79-09609

THE MORPHOMETRICS OF GLACIALLY DERIVED LAKES AND SWAMPS,
Georgia Univ.-Athens.
R. J. Mathieu.
Ph.D. Dissertation, 1977. 179 p, 18 fig, 51 tab, 174 ref, 1 append.

Descriptors: *Swamps, *Lake morphology, *Glaciers, Wetlands, Lakes, Shape, Lake shores, Geomorphology.

The morphology of lakes and swamps varied with glacial provenance. The most significant characteristics which distinguish lakes formed in a scoured region from those in a depositional environment are that the mean size of lakes--which range from 10 to 640 acres--is greater in the scoured area, as are the perimeters and lengths. The circularity ratios are the fourth major difference and they are lower in the scoured environment. The similarities between the two regions were width of lakes, orientation, and generally high correlation among the variables. The swamps in the two glacial environments are also significantly different. The swamps in the scoured region are smaller, more irregular in shape, and exhibit a more significant correlation between area and perimeter. Most of these differences in lakes and swamps reflect the unique glacial processes that have operated in the two regions. (Steiner-Mass)
W79-09633

PEAT UTILIZATION AND THE RED LAKE INDIAN RESERVATION.
Butler (Walter) Co., St. Paul, MN.
Minnesota Department of Natural Resources, Division of Minerals. 1978. 194 p. 14 fig, 26 tab, 200 ref, 1 append.

Descriptors: *Minnesota, *Red Lake Indian Reservation, *Wetlands, *Peat, Census, Economics, Wildlife, Fish, Forestry, Social values, Bogs.

Key environmental, social, and economic issues of the use, or non-use, of the peat resource in the Red Lake Indian Reservation area are identified and elaborated upon. The study has three focuses. The first is acquisition of specific information about peat utilization. The second focus is the communication of information to the Reservation residents. The third focus is to compile an inventory of opinions and attitudes of Red Lake residents toward peat developments. (Steiner-Mass)
W79-09634

LOUISIANA PARISH BOUNDARIES THROUGH LAKES, BAYS, AND SOUNDS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 6E.
W79-09636

DIFFERENTIAL USE OF FRESH WATER ENVIRONMENTS BY WINTERING WATERFOWL OF COASTAL TEXAS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
D. H. White, and D. James.
The Wilson Bulletin, Vol. 90, No. 1, p 90-111, March, 1978. 6 fig, 1 tab, 30 ref.

Descriptors: *Waterfowl, *Niches, *Oxbow Lakes, Freshwater, Texas, Coast, Environmental gradient, Ecology, Aquatic plants, Rooted aquatic plants, Floating plants, Submerged plants, Water chemistry, Hydrogen ion concentration, Dissolved oxygen, Nitrogen, Phosphorus, Calcium, Conductivity, Turbidity, Migratory birds, Ducks.

A comparative study of the environmental relationships among 14 species of wintering waterfowl was conducted in the coastal region of Southern Texas during the fall and early winter of 1973. Measurement of 20 environmental factors (social, vegetational, physical, and chemical) were subjected to multivariate statistical methods to determine certain niche characteristics and environmental relationships of waterfowl wintering in the aquatic community. Each waterfowl species occupied a unique realized niche by responding to distinct combinations of environmental factors identified by principal component analysis. The waterfowl environments were significantly different interspecifically and water depth at feeding site and % emergent vegetation were most important in the separation. Four waterfowl groups were significantly separated along an aquatic cline from shallow water to open deep water, with clumping of the bird species toward the middle of the available habitat. (Bollinger-Mass)
W79-09638

VEGETATION TYPES, SPECIES AND AREAS OF CONCERN, AND FOREST RESOURCES UTILIZATION OF NORTHERN MINNESOTA'S PEATLANDS,
Minnesota Univ., St. Paul. Coll. of Forestry.
For primary bibliographic entry see Field 2I.
W79-09641

A GUIDE TO PLANTS COMMONLY FOUND IN THE FRESHWATER WETLANDS OF NEW YORK STATE,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 2I.
W79-09642

LANDSCAPE EVOLUTION, PEATLAND TYPES, AND THE ENVIRONMENT IN THE LAKE AGASSIZ PEATLANDS NATURAL AREA, MINNESOTA,
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 2I.
W79-09644

PLANT AND INSECT COMMUNITIES IN A MINNESOTA WETLAND,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 2I.
W79-09648

EMERGENT MACROPHYTES OF A WISCONSIN MARSH: PRODUCTIVITY, SOIL-PLANT NUTRIENT REGIMES, AND UPTAKE EXPERIMENTS WITH PHOSPHORUS-32,
Wisconsin Univ.-Milwaukee.
For primary bibliographic entry see Field 2I.
W79-09649

CORTICOLOUS EPIPHYTES IN NORTH CENTRAL WISCONSIN BOGS,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 2I.
W79-09650

LAKESHORE PHYSIOGRAPHY AND USE,
R. E. Carlson.
Shore and Beach, Vol. 40, No. 1, April, 1972, p 3-14. 6 fig, 6 tab.

Descriptors: *Lake shore, *Branches, *Shores, *Shore erosion, Lake geomorphology, Wetlands, Water resources.

A resource and land use inventory of the Great Lakes shorelands of the U.S. was developed based on eight different criteria: shoreline mileages; existing shoreline use; shore types; beach zone material; public ownership; significant fish, wildlife, ecological and natural areas; erosion and flooding areas; and locations of public facilities. Shoreline use was classified into eight categories: residential, commercial, industrial, public buildings and related lands, agricultural and undeveloped lands, recreational, fish and game lands, and forests. Ten different shore types were identified according to topography and erodibility. Maps are included of the shoreline use and ownership of all the Great Lakes. (Hinkel-Mass)
W79-09653

WATER QUALITY OF LIVINGSTON RESERVOIR ON THE TRINITY RIVER, SOUTHEASTERN TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
J. Rawson.
Texas Department of Water Resources Report 230, April 1979. 46 p, 16 fig, 16 tab, 7 ref.

Descriptors: *Water quality, *Reservoirs, *Inflow, *Thermal stratification, Seasonal, Water analysis, Dissolved solids, Dissolved oxygen, Iron, Manganese, Nitrogen, Phosphorus, Chlorides, Sulfates, Hardness(Water), Texas, *Livingston Reservoir(TX), Trinity River(TX).

The concentrations of dissolved solids, chloride, and sulfate in Livingston Reservoir on the Trinity River in southeastern Texas usually average less than 250 mg/L (milligrams per liter), 40 mg/L, and 50 mg/L, respectively. The water is usually hard or moderately hard (61 to 180 mg/L as calcium carbonate). The concentrations of principal dissolved constituents in the reservoir are usually maximum during summer and fall when evaporation is high and inflow is low. Thermal stratification of the reservoir usually begins in March and persists until September or October. Neither the seasonal variation of dissolved constituents in inflow to the reservoir nor thermal stratification has resulted in significant stratification of the principal dissolved constituents. However, thermal stratification has resulted in significant seasonal and areal variations of dissolved oxygen, which results in higher concentration of dissolved iron, dissolved manganese, total phosphorus, and total inorganic nitrogen. (Woodard-USGS)
W79-09734

DISSOLVED-OXYGEN DEPLETION AND OTHER EFFECTS OF STORING WATER IN FLAMING GORGE RESERVOIR, WYOMING AND UTAH,
Geological Survey, Tacoma, WA. Water Resources Div.
E. L. Bolke.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.80. Geological Survey Water-Supply Paper 2058, 1979. 41 p, 12 fig, 6 tab, 8 ref.

Descriptors: *Reservoirs, *Limnology, *Dissolved oxygen, *Thermocline, *Dissolved solids, Inflow, Mixing, Algae, Water storage, Effects, Water quality, *Flaming Gorge Reservoir(Wyo-Utah).

Circulation in Flaming Gorge Reservoir is caused primarily by insolation, inflow-outflow relationships, and wind action. During 1970-75 there was little annual variation in the thickness, dissolved oxygen, and specific conductance of the hypolimnion near Flaming Gorge Dam. The lowest dissolved-oxygen concentration occurred simultaneously in the bottom waters of both major tributary arms in the upstream part of the reservoir and was due to reservoir stratification. Anaerobic conditions in the bottom water during summer stratification eventually resulted in a metalimnetic oxygen minimum in the reservoir. The depletion of flow in the Green River below the dam due to evaporation and bank storage in the reservoir for the 1963-75 period was 1,320 cubic hectometers, and the increase of dissolved-solids load in the river was 1,947,000 metric tons. The largest annual variations in dissolved-solids concentration in the river were about 600 milligrams per liter before closure of the dam and about 200 milligrams per liter after closure. The most significant changes in the individual dissolved-ion loads in the river were an increase in sulfate and a decrease in bicarbonate. The maximum range in temperature in the river below the dam prior to closure in 1962 was from 0C in winter to 21C in summer. After closure until 1970, the temperature ranged from 2C to 12C, but since 1970 the range has been from 4C to 9C. (Woodard-USGS)
W79-09738

WATER-QUALITY RECORDS FOR SELECTED RESERVOIRS IN TEXAS, 1974-75 WATER YEARS,
Geological Survey, Austin, TX. Water Resources Div.
J. Rawson, and E. S. Chitwood.
Texas Department of Water Resources Report 232, May 1979. 162 p, 18 fig, 84 tab, 13 ref.

Descriptors: *Water quality, *Reservoirs, *Texas, *Water analysis, *Chemical analysis, Basic data collections, Sampling, Sites.

Periodically since October 1961, the U.S. Geological Survey, in cooperation with State, Federal, and local agencies has made comprehensive water-quality surveys of selected reservoirs in Texas. During the 1970 water year, the program was expanded to include periodic sampling of many other reservoirs in the State where water-quality surveys were not being made. Water-quality data collected before October 1973 have been published previously. This report contains the results of water-quality surveys of 17 reservoirs and chemical analyses of samples collected periodically from 58 reservoirs during the 1974-75 water year. (Woodard-USGS)
W79-09742

THE ATMOSPHERIC CONTRIBUTION OF PHOSPHORUS TO AN AQUATIC SYSTEM,
Williams Bros. Engineering Co., Tulsa, OK.
For primary bibliographic entry see Field 5B.
W79-09755

FACTORS INFLUENCING PH IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5A.
W79-09756

2I. Water In Plants

WETLANDS: ECOLOGY, VALUES, AND IMPACTS, PROCEEDINGS OF THE WAUBESA CONFERENCE ON WETLANDS, JUNE 2-5, 1977, MA DISON, WISCONSIN.
Institute for Environmental Studies, University of Wisconsin, Madison (1978). 388 p, 3 append.

Descriptors: *Wetlands, *Wisconsin, *Marshes, *Swamps, *Ecology, Wildlife, Vegetation, Rooted aquatic plants, Wastewater, Soils, Nutrients, Protection, Remote sensing, Systems analysis.

The 27 papers presented in the proceedings of the Waubesa Conference on Wetlands are grouped into eight categories: Wetland soils, nutrition, and productivity, Environmental impacts, Wetland

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protection and restoration, Wetlands for wastewater treatment, Wetland system studies, Wetland animals, Wetland mapping, and Patterns and dynamics of wetland communities. The abstracts of seven papers not presented in this volume are presented in Appendix 1. A majority of the papers deal with the wetlands of Wisconsin. A list of films on wetlands and related topics, excerpts from the conference program and an index are provided. (See W79-09582 thru W79-09608) (Stihler-Mass)
W79-09581

PRIMARY PRODUCTIVITY AND MINERAL REGIMES IN A NORTHERN WISCONSIN MARSH,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
D. Lindsley, T. Schuck, and F. Stearns.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 38-52. (1978) 3 fig, 18 ref.

Descriptors: *Primary productivity, *Rooted aquatic plants, *Freshwater marshes, Wetlands, Marshes, Sands, Nutrients, Vegetation, Wisconsin.

McNaughton Marsh, located on the Wisconsin River in north central Wisconsin, is underlain by sands of the Vilas/Crivitz series. During the 1974 growing season, primary production of five species of emergent aquatics was determined monthly. Net primary production was found to approximate values reported from much more eutrophic sites elsewhere in North America. Daily productivity above-ground, from the beginning of growth to the time of peak biomass, was as follows: Sagittaria latifolia 4.39 g/sq m, Eleocharis palustris 4.32 g/sq m, Juncus effusus validus 6.3 g/sq m. Mineral nutrient concentrations in McNaughton Marsh plants are comparable to those reported elsewhere despite the low levels of available minerals in these sandy soils. The nature of the substrate is important in nutrient uptake. Plants growing in McNaughton Marsh appear to 'skim off' nutrients from the substrate as rapidly as they are received from river flow and runoff. The degree to which the river nutrient load can be increased without altering the functioning of the marsh system must be resolved by further research. (See also W79-09581) (Stihler-Mass)
W79-09584

PRODUCTIVITY AND BIOMASS OF VASCULAR HYDROPHYTES ON THE UPPER MISSISSIPPI,
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
D. F. Sefton.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 53-61. (1978) 2 fig, 4 tab, 9 ref.

Descriptors: *Primary productivity, *Biomass, *Rooted aquatic plants, *Mississippi River, Wetlands, Ponds, Vegetation, Littoral, Wisconsin, Minnesota.

During the summer of 1975 hydrophyte samples were taken at sites evenly spaced along transects in each of 41 study areas in Navigation Pool 8 of the Upper Mississippi River. A diverse, typical hard-water flora was found. Submergent Ceratophyllum demersum was the most frequently occurring species, while the greatest portion of the total biomass of Pool 8 consisted of the emergent Sagittaria latifolia. The average summer crop of 181.70 g/sq m for the littoral zone was comparable to that for hard water lakes in Wisconsin. Two areas, typical of the mid and lower sections of Pool 8, were sampled six times between May 28 and August 25, 1976. Maximum productivity rates were coincident with the flowering and fruiting of Nelumbo pentapetala, Sagittaria latifolia and Vallisneria americana. S. latifolia was the most productive. (See also W79-09581) (Stihler-Mass)
W79-09585

THE IMPACT OF THE COLUMBIA GENERATING STATION ON THE SURFACE AND GROUNDWATER HYDROLOGY OF A RIVER FLOODPLAIN WETLAND,
Wisconsin Univ.-Madison. Dept. of Geology.
C. B. Andrews.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 64-76. (1978) 8 fig, 6 ref.

Descriptors: *Utilities, *Hydrology, *Marshes, *Groundwater, *Surface water, Effects, Wetlands, Simulation analysis, Floodplains, Lakes, Rooted aquatic plants, Vegetation, Wisconsin.

The most obvious impacts of the Columbia Generating Station, a 500 megawatt coal fired power plant, were those related to the construction of a 160 ha cooling lake and a 30 ha ashpit. Two-dimensional vertically-oriented transient models of the groundwater flow system were used to simulate water and heat flow in the subsurface before and after the filling of the cooling lake and ashpit. Groundwater discharge to the wetland has increased 500% and water temperatures in the plant rooting zone are now out of phase with seasonal changes and vary as much as 15 degrees centigrade from normal levels. (See also W79-09581) (Stihler-Mass)
W79-09586

SEASONALLY DISPLACED WATER TEMPERATURES AS A FACTOR AFFECTING DEPLETION OF STORED CARBOHYDRATES IN TYPHA LATIFOLIA,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 5C.
W79-09588

SOME OBSERVATIONS ON THE RELATIONSHIP OF FLOODPLAIN SILTATION TO REED CANARY GRASS ABUNDANCE,
Southeastern Wisconsin Regional Planning Commission, Waukesha.
D. M. Reed, J. H. Riemer, and J. A. Schwarzmeier.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 99-107. (1978) 4 fig, 1 tab, 4 ref.

Descriptors: *Floodplains, *Silting, *Rooted aquatic plants, *Ecological distribution, Wetlands, Marshes, Rivers, Flooding, Ecology, Vegetation.

Observations in the Pewaukee and Fox (Illinois) River floodplains in Waukesha County, Wisconsin suggest indicator relationships between reed-canary grass (Phalaris arundinacea) dominated marshes/meadows and one or more of the following conditions: (1) floodplain landfills, (2) former floodplain pastures, (3) adjacent upland uses which accelerate runoff, and (4) strong silt deposition in floodplains. Hummock spatial relationships and wetland floor elevations were studied in relation to reed-canary grass abundance at the Fox River site; these data suggested a significant loss of annual floodwater capacity because of heavier silt deposition in reed-canary grass portions. (See also W79-09581) (Stihler-Mass)
W79-09589

PRESERVING WETLANDS IN NORTHEASTERN ILLINOIS,
Illinois Nature Preserves Commission, Rockford.
For primary bibliographic entry see Field 4C.
W79-09591

OPENING STATEMENT ON WETLAND RESTORATION,
Waukesha County Park and Planning Commission, WI.
J. Schwarzmeier.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 129-131. (1978) 1 fig, 2 ref.

Descriptors: *Wetlands, *Marshes, Habitats, Wisconsin, Water levels, Restoration.

One of the most basic tenets to sound community restoration seems to be consideration of connective corridor relationships between a potential site and sizable habitats. Shallow marsh restoration is a basic problem needing attention. Creation of specific average mid-summer water levels will somewhat automatically cause a relatively quick successional-type change to a specific wetland community. (See also W79-09581) (Stihler-Mass)
W79-09593

WETLANDS RESTORATION, A NEW PROCESS,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
F. Stearns.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 132-135, (1978).

Descriptors: *Wetlands, *Planning, *Rooted aquatic plants, Seeds, Marshes, Soils, Shorelines, Water level fluctuation, Aquatic plants, Restoration.

Methods of wetland restoration are related to the cause of damage and destruction. A water source is essential, and there must be a place where water can accumulate. Seed sources are essential for the establishment of wetland plants; where a marsh once existed there will often be a seed bank in the soil. Wetlands are easy to restore provided that a gradual shoreline (perhaps 1% slope above and below waterline) and sunlight are available and that there is some fluctuation of water levels. Before beginning any wetland restoration project, one must set priorities and goals. (See also W79-09581) (Stihler-Mass)
W79-09594

RESTORATION OF A SMALL SUBURBAN SOUTHERN WISCONSIN WETLAND,
Wisconsin Univ.-Madison. Dept. of Landscape Architecture.
T. Lahti.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 136-163, (1978) 13 fig, 6 tab, 42 ref.

Descriptors: *Marshes, *Rooted aquatic plants, *Vegetation, Wetlands, Wisconsin, Ecological distribution, Soils, Water table, Sediments, Ecology, Restoration.

The vegetation of four southern Wisconsin wetlands was analyzed along an environmental gradient. Four sets of plant associations were delineated: Pioneer, Cattail, Sedge Swale, and Wet Meadow-Shrub associations. A complex interaction of hydrologic, edaphic, biotic and physiographic influences were thought to be responsible for the present pattern of wetland vegetation distribution. Physiographic variability was considered primarily responsible for vegetational zonation by influencing the hydrologic, edaphic, and biotic conditions. A restoration project in suburban Madison, Wisconsin was implemented to gain insight into the various aspects of applied wetland restoration. The severe summer drought of 1976 made plant survival difficult; however, relatively good success was noted at the end of the growing season. Water loss via infiltration, invasion by aggressive disturbance plants and relatively high amounts of sediment deposition created some maintenance problems. (See also W79-09581) (Stihler-Mass)
W79-09595

NATURAL AND IRRIGATION HYDROLOGY OF THE PORTER RANCH PEATLAND,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
R. H. Kadlec.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 198-229. (1978) 28 fig, 6 tab, 4 ref.

Descriptors: *Hydrology, *Wetlands, *Irrigation, Precipitation, Evaporation, Groundwater, Surface waters, Wastewater, Summer, Biological treatment, Beaver, Peats.

All outflows and inflows, precipitation, evaporation, and accumulation were measured for the main 7.0 sq km wetland. No significant communication with groundwater was measured, and the surface water budget closes. Precipitation and evapotranspiration are the principal contributions to the water budget, but spring stream flow is significant for a brief period in May. Water levels drop throughout the summer period, and the drought of late summer 1976 accentuated this. Beaver control of stream flows was observed to be significant. Over 10 million gallons of secondarily treated wastewater were pumped to the peatland and distributed via a 200 meter gated irrigation pipe during the period May to September 1976. The added water spread in an irregular concentric pattern, creating a very shallow mound of surface water. The area of the mound ranged upward from 40,000 sq m at an average depth of about 3 cm, depending upon precipitation and evapotranspiration. The prevailing drought conditions created a dry soil condition surrounding the pumped water mound. A concentric elliptical ring compartment budget was developed to summarize details of water movement and storage. (See also W79-09581) (Stihler-Mass)
W79-09598

THE USE OF MODELS TO STUDY WETLAND REGULATION OF NUTRIENT LOADING TO LAKE MENDOTA,
Wisconsin Univ.-Madison. Dept. of Botany.
For primary bibliographic entry see Field 6A.
W79-09600

VEGETATION CHANGES AND WATER LEVELS IN A SMALL MICHIGAN BOG,
Wisconsin Univ.-Green Bay. Coll. of Environmental Sciences.
C. R. Schwintzer.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 326-336, 1978. 2 tab, 24 ref.

Descriptors: *Bogs, *Vegetation, *Water levels, Wetlands, Shrubs, Trees, Ecology, Michigan.

Bryant's Bog consists of two concentric zones, a free floating and a grounded mat surrounding a central pool. Quantitative descriptions of the vegetation are available for several years since 1917. The vegetation changed from the Chamaedaphne association of 1917 to the high bog-shrub association in the 1920's to a bog forest which was well established in the late 1960's. The majority of the trees died in the early 1970's. The two zones differed in species composition, biomass, and extent of tree mortality. Water levels are the most probable cause of the tree mortality and differences in the two zones. (See also W79-09581) (Stihler-Mass)
W79-09606

GREEN BAY'S COASTAL WETLANDS--A PICTURE OF DYNAMIC CHANGE,
Wisconsin Univ.-Green Bay.
H. J. Harris, T. R. Bosley, and F. D. Roznik.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 337-358, 1978. 7 fig, 6 tab, 14 ref.

Descriptors: *Lake Michigan, *Shoreline, *Wetlands, *Wisconsin, Lakes, Marshes, Swamps, Shrubs, Rooted aquatic plants, Ecosystems, Ecology, Water level fluctuations, Aquatic life, Green Bay.

Coastal freshwater wetlands of Green Bay are unique insofar as they represent a wetland ecosystem possessing some characteristics of small inland glacial marshes and some characteristics of large marine estuarian systems. The authors suggest that these wetlands are 'pulse stable' systems and that the organisms of these wetland ecosystems are adapted, to a greater or lesser degree, to the periodic changes that occur in the system and further that these periodic changes brought about by short- and long-term water level fluctuation may be important in the maintenance of the productivity of the system. (See also W79-09581) (Stihler-Mass)
W79-09607

PATTERNED VEGETATION IN CEDARBURG BOG, WISCONSIN,
Wisconsin Univ. Center System, Sheboygan. Dept. of Biological Sciences.
T. F. Grittinger.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 359-363, 1978. 1 fig, 1 tab, 10 ref.

Descriptors: *Vegetation, *Bogs, *Wisconsin, *Ecological distribution, Coniferous trees, Birch trees, Shrubs, Rooted aquatic plants, Flow, Wetlands.

Aerial observations of Cedarburg Bog reveal a mosaic of patterns reflecting vegetational differences. The most unique of these patterns is the string bog or 'strangmoor.' It is unusual to find this type of patterned vegetation this far south. The string bog consists of slightly elevated peaty ridges and islands with cedar, tamarack, bog birch, leatherleaf and other woody species, alternating with relatively flat areas supporting sedges and other nonwoody species. This string bog, like others, is found on a slightly sloping surface; the patterns lie at right angles to the slope. Apparently this orientation indicates the importance of water flow in pattern formation. (See also W79-09581) (Stihler-Mass)
W79-09608

FRESHWATER WETLANDS: ECOLOGICAL PROCESSES AND MANAGEMENT POTENTIAL.
R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, New York. 1978. 378 p.

Descriptors: *Wetlands, *Freshwater, *Ecology, *Management, Marshes, Tidal marshes, Coastal marshes, Freshwater marshes, Ecosystems, Biomass, Standing crops, Rooted aquatic plants, Vegetation, Bogs, Hydrology, Primary productivity, Decomposing organic matter, Lakes, Littoral, Nutrients, Seasonal.

This publication is the proceedings of a symposium on freshwater wetlands: present status, future needs, held in February, 1977, at Rutgers University, New Brunswick, New Jersey. The 23 papers are placed into four categories: primary production processes, decomposition processes, nutrient dynamics and management potential. Wetland types discussed include freshwater tidal wetlands, prairie glacial marshes, sedge wetlands, northern bog wetlands, and riverine and lakeshore marshes. (See W79-09610 thru W79-09632) (Stihler-Mass)
W79-09609

BIOMASS AND PRIMARY PRODUCTION IN FRESHWATER TIDAL WETLANDS OF THE MIDDLE ATLANTIC COAST,
Rider Coll., Trenton, NJ. Dept. of Biology.
D. F. Whigham, J. McCormick, R. E. Good, and R. L. Simpson.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors. Academic Press, New York, p 3-20. 2 fig, 4 tab, 39 ref.

Descriptors: *Primary productivity, *Atlantic coastal plain, *Wetlands, Freshwater marshes, Tidal marshes, Mortality, Rooted aquatic plants, New Jersey, Biomass, Cattails.

Based on literature review, it appears that freshwater tidal wetlands may be more productive than saline wetlands at the same latitude and that typical freshwater tidal wetland species are usually the most productive species when they occur in brackish wetlands. The authors' studies in a New Jersey tidal wetland demonstrate that belowground production, leaf mortality during the growing season, herbivery and plant turnover during the growing season may account for at least 50% of the total net community production. If this value is accurate, the estimated production of freshwater tidal wetlands within the Middle Atlantic coastal region ranges from approximately 1000 g/sq m to 3500 g/sq m. (See also W79-09609) (Stihler-Mass)
W79-09610

PRIMARY PRODUCTION OF PRAIRIE GLACIAL MARSHES,
Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.
A. G. van der Valk, and C. B. Davis.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 21-37. 6 fig, 4 tab, 33 ref.

Descriptors: *Primary productivity, *Standing crops, *Freshwater marshes, Wetlands, Marshes, Grasslands, Vegetation, Rooted aquatic plants, Submerged plants, Seasonal.

On the basis of clip plot studies, the average maximum shoot standing crop of emergent species in Iowa prairie marshes ranges from 330 g/sq m to 1,160 g/sq m depending on the species. Submersed communities have a maximum standing crop of 190 g/sq m and mud flat communities of 600 g/sq m. Belowground maximum standing crops range from 360 g/sq m to 1,945 g/sq m among emergent species and annual belowground production of emergents ranges from 508 g/sq m to 640 g/sq m. Annual shoot net primary production is underestimated by maximum standing crop values by 2 to 22% for 5 emergent species. For these same species, net primary productivity varies from 4 to 23 g/sq m/day. Because of the cyclical changes that occur in the vegetation of Iowa prairie marshes over a period of 5 to 20 years, total annual shoot production in a marsh can change 18-fold among different stages in the cycle. (See also W79-09609) (Stihler-Mass)
W79-09611

LIFE HISTORY ASPECTS OF PRIMARY PRODUCTION IN SEDGE WETLANDS,
Ithaca Coll., NY. Dept. of Biology.
J. M. Bernard, and E. Gorham.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 39-51. 2 fig, 4 tab, 30 ref.

Descriptors: *Primary productivity, *Rooted aquatic plants, Wetlands, Freshwater marshes, Standing crops, Mortality, Life history studies, Plant populations, Sedges, Carex spp.

Sedge shoots differ in their life history; some such as Carex lacustris live for a maximum of 12 to 14 months whereas others such as C. rostrata live for approximately 2 years. Mortality is very high and as many as 80 to 90% of shoots emerging do not complete the maximum possible life-span. Most sedge wetlands have maximum green standing crop values of < 1,000 g/sq m; the highest reported value is 1,283 g/sq m. Such values indicate primary production in these wetlands to be < 1,000 g/sq m/yr when based on the harvest method. When life history of the shoots, especially mortality, is determined, productivity values are higher; C. lacustris production then approaches 1,600 g/sq m/yr. (See also W79-09609) (Stihler-Mass)
W79-09612

PRIMARY PRODUCTION IN NORTHERN BOG MARSHES,
Guelph Univ. (Ontario). Dept. of Botany and Genetics.
R. J. Reader.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 53-62. 2 tab, 26 ref.

Descriptors: *Primary productivity, *Tundra, *Bogs, *Marshes, Wetlands, Fens, Rooted aquatic

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plants, Vegetation, Plant growth, Standing crops, Freshwater, Temperature.

Harvest-method estimates of primary productivity in nine northern bog marshes (i.e. fens, minerotrophic peatlands, tundra, sedge meadows) reported in the literature ranged from 101 g/sq m/yr to 1026 g./sq m/yr for aboveground plant parts and 141 to 513 g/sq m/yr for belowground portions. No single taxon consistently made the greatest contribution to the production total. Environmental factors limiting the productivity of northern bog marshes include the length of the growing season, maximum summer air temperature, nutrient availability (especially N, P and K) and waterlogging. The relative importance of these factors apparently depends on the species composition and the location of the bog marsh. (See also W79-09609) (Stihler-Mass)
W79-09613

THE ROLE OF HYDROLOGY IN FRESHWATER WETLAND ECOSYSTEMS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
J. G. Gosselink, and R. E. Turner.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 63-78. 6 fig, 3 tab, 36 ref.

Descriptors: *Hydrology, *Wetlands, *Freshwater marshes, Bogs, Hydrologic cycle, Nutrients, Oxygen, Classification, Primary productivity, Organic matter, Freshwater marshes.

The source, velocity, renewal rate and timing of the water in a wetland ecosystem directly controls the spatial heterogeneity of wetlands and nutrient, O2, and toxin load of the sediments. These secondary factors in turn control or modify such ecosystem characteristics as species composition and richness, primary productivity, organic deposition and flux and nutrient cycles. Six classes of freshwater wetlands are recognized based on source and velocity of water flow--raised-convex, meadow, sunken minerotrophic, lotic, tidal and lentic. (See also W79-09609) (Stihler-Mass)
W79-09614

PRIMARY PRODUCTION PROCESSES: SUMMARY AND RECOMMENDATIONS,
Mississippi State Univ., Mississippi State.
A. A. de la Cruz.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 79-86. 3 tab, 22 ref.

Descriptors: *Primary productivity, *Wetlands, *Freshwater marshes, Life history studies, Hydrology, Soils, Rooted aquatic plants, Research and development.

Although few accurate estimates of net annual productivity, either above- or belowground, exist for freshwater wetlands, available data suggests that they may be among the most productive naturally occurring ecosystems. It is becoming clear that hydrology and soil chemistry are extremely important in influencing productivity. Future studies should employ standardized techniques and must consider hydrology, soil regimes, community type, species life history and several extrinsic biological factors. (See also W79-09609) (Stihler-Mass)
W79-09615

DECOMPOSITION OF INTERTIDAL FRESHWATER MARSH PLANTS,
Virginia Univ., Charlottesville. Dept. of Environmental Studies.
W. E. Odum, and M. A. Heywood.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 89-97. 5 fig, 7 ref.

Descriptors: *Decomposing organic matter, *Tidal marshes, *Freshwater marshes, *Rooted aquatic plants, Wetlands, Marshes, Vegetation, Nitrogen, Carbon.

This paper summarizes the existing information concerning decomposition of marsh plants which grow in the regularly flooded portions of freshwater tidal marshes. The 6 species investigated (Peltandra virginica, Nuphar luteum, Pontederia cordata, Bidens laevis, Zizania aquatica, Sagittaria latifolia) all exhibit rapid rates of decomposition. Typically, 40 to 50% of the original ash-free dry weight is lost from litterbags within 10 days and 70 to 80% within 60 days. These marsh plants appear to decay more rapidly and produce larger quantities of dissolved organic matter than the salt-tolerant plants from higher salinity, coastal marshes. There are indications that they contain more N and that the pattern of N change during decomposition differs from that of the higher salinity plants. The leaves of Peltandra virginica contain initially between 2 to 3% N on an ash-free dry weight basis. During decomposition this may increase to 4 to 5.5% N during the first 20 days and then decline to 3 to 3.8% after 50 days. The C:N ratio follows a similar, but inverse pattern. (See also W79-09609) (Stihler-Mass)
W79-09616

LITTER DECOMPOSITION IN PRAIRIE GLACIAL MARSHES,
Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.
C. B. Davis, and A. G. van der Valk.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 99-113. 5 fig, 1 tab, 13 ref, 1 append.

Descriptors: *Decomposing organic matter, *Freshwater marshes, *Iowa, *Rooted aquatic plants, Wetlands, Marshes, Litter, Leaching, Life history studies, Potassium, Phosphorusm, Sodium, Magnesium, Nitrogen, Iron, Biomass, Nutrients.

Data from permanent quadrats show that shoot death begins in early June for Carex atherodes, in late July for Scirpus validus and Scirpus fluviatilis, and in September for Sparganium eurycarpum and Typha glauca. Studies of standing and fallen litter were conducted on these 5 emergent species. Losses from the standing litter compartment are primarily the result of fragmentation that occurs during the first winter and spring. Leaching from the standing litter may also remove nutrients in the first few weeks after shoot death. In the fallen litter, K, Na, and Mg were released very rapidly, while N, P, and Ca were released more slowly. In contrast, Al and Fe were accumulated by fallen litter in all species. Release and uptake of nutrients by fallen litter varied from species to species, from site to site for the same species, and seasonally. Scirpus validus fallen litter lost the most weight followed, in turn, by Sp. eurycarpum, T. glauca, and C. atherodes litter. Fallen litter was submersed only in the spring and early summer. The amount of time fallen litter was submersed varied from species to species in the marsh. Flow models for N, P, K, and Ca summarize the available information on the seasonal flux of these nutrients in the standing and fallen litter compartment of prairie glacial marshes. (See also W79-09609) (Stihler-Mass)
W79-09617

DECOMPOSITION IN NORTHERN WETLANDS,
South Dakota State Univ., Brooking. Dept. of Botany and Biology.
J. P. M. Chamie, and C. J. Richardson.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 115-130. 4 fig, 2 tab, 45 ref.

Descriptors: *Decomposing organic matter, *Wetlands, *Rooted aquatic plants, Litter, Vegetation, Trees, Peats, Nitrogen, Calcium, Potassium, Phosphorus, Magnesium, Michigan.

Northern wetland decomposition processes were reviewed and litterbag data obtained from 4 commonly occurring plant groups in a central Michigan peatland from 1973 to 1975. Air-dried leaves, small stems and large stems of Salix spp., Carex spp., Betula pumila and Chamaedaphne calyculata were confined in nylon mesh bags (1-mm mesh) for periods up to 590 days. The effects of aerobic and anaerobic conditions on decomposition were determined via dry weight losses, rates of decay and nutrient concentration changes for N, P, K, Ca and Mg. Percentages of dry weight remaining after nearly 2 years were always > 58% of the initial weight for any plant group. The 99% turnover time for most of the vegetation components in the wetland exceeded 10 years. An estimate of organic peat turnover time at the ecosystem level was 5,000 to 10,000 years. Anaerobic decomposition occurred more slowly 15 cm below the peat--water interface than at the interface. For most species and their parts, nutrient concentration losses occurred in P, K and Mg while increases occurred in N and Ca. Elemental mobility followed the order: K > Mg > P > N > Ca. (See also W79-09609) (Stihler-Mass)
W79-09618

DECOMPOSITION IN THE LITTORAL ZONE OF LAKES,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
G. L. Godshalk, and R. G. Wetzel.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. G. Whigham and R. L. Simpson, editors, Academic Press, New York, p 131-143. 2 fig, 3 tab, 14 ref.

Descriptors: *Decomposing organic matter, *Lakes, *Littoral, *Rooted aquatic plants, Wetlands, Vegetation, Nitrogen, Carbon, Temperature, Oxygen, Ecology, Submerged plants, Microorganisms, Organic matter.

The decomposition of five species of angiosperms, representing floating-leaved, submerged and emergent forms was studied in laboratory and field experiments. Laboratory investigations involved the decay of lyophilized senescent plant material in synthetic lake water under aerobic and anaerobic conditions at both 10 and 25 degrees C. Plant tissue was also placed at sites in the littoral zones of 2 lakes at 2 times of the year in order to monitor in situ decomposition processes. Temperature was the most important factor influencing the rates of decomposition and the conversion of particulate matter to dissolved organic matter (DOM). Oxygen concentration controlled the efficiency of decomposition and the conversion of DOM to CO2. The interaction of these two factors produces a continuum of decomposition rates from very slow under cold anaerobic conditions to rapid under warm aerated conditions. The floating-leaved water lilies decayed fastest; submersed plants were intermediate and emergent species decayed most slowly. In situ decomposition paralleled laboratory results. (See also W79-09609) (Stihler-Mass)
W79-09619

DECOMPOSITION PROCESSES: SUMMARY AND RECOMMENDATIONS,
Georgia Univ., Sapelo Island. Marine Inst.
J. L. Gallagher.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 145-151. 1 fig, 8 ref.

Descriptors: *Decomposing organic matter, *Freshwater, *Wetlands, Rooted aquatic plants, Vegetation, Litter, Marshes, Methodology.

Although much criticism has been directed at the use of litterbags, they do provide a reproducible approximation of decomposition rates which integrate the effects of daily or weekly environmental variations. The curves consistently have a negative exponential shape. Materials exposed to warm, moist, aerobic conditions decay more rapidly than those exposed to cold, dry, anaerobic conditions; woody plants decay more slowly than herbaceous vegetation. Some weight losses noted in litterbags

are due to losses of mineral rather than carbon compounds. There is virtually no data on decomposition rates of the root systems of freshwater wetland plants. (See also W79-09609) (Stihler-Mass)
W79-09620

CHEMICAL COMPOSITION OF WETLAND PLANTS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 155-167. 6 tab, 56 ref.

Descriptors: *Chemical analysis, *Elements(Chemical), *Rooted aquatic plants, *Freshwater, Variability, Vegetation, Algae, Energy, Marshes, Wetlands, Carbon, Nitrogen, Potassium, Phosphorus, Sulfur, Magnesium, Sodium, Iron, Zinc, Copper, Organic matter.

Examination of data on the chemical composition of wetland plants reveals that variation in composition increases in the following order: within-site intraspecific variation, between-site intraspecific variation, and interspecific variation. Furthermore, chemical composition changes as some species mature and variation in chemical composition occurs between different plant structures. No average composition for an individual species or ecological grouping of species based on data from the literature would be reliable. Therefore, actual measurements should be made in studies requiring data on chemical composition. Energy content values are more constant than chemical parameters. (See also W79-09609) (Stihler-Mass)
W79-09621

NUTRIENT MOVEMENTS IN LAKESHORE MARSHES,
Wisconsin Univ.-Madison. Dept. of Botany.
R. T. Prentki, T. D. Gustafson, and M. S. Adams.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 169-194, 5 fig, 2 tab, 76 ref.

Descriptors: *Lakes, *Shores, *Freshwater marshes, *Cycling nutrients, Marshes, Wetlands, Seasonal, Rooted aquatic plants, Cattails, Phosphorus, Nitrogen, Roots, Movement, Ecology, Wisconsin.

Seasonal phosphorus allocation in Typha latifolia L. was investigated by analysis of above- and belowground parts in a lakeshore marsh at Lake Mendota, Wisconsin. Maximum total P stocks of 4.3 and 2.2 to 2.5 g P/sq m were found in summer and winter, respectively. A maximum upward translocation of 140 mg P/sq m, one-third due to mobilization of belowground reserves, was observed the first 2 weeks of June. Over an entire summer, 40% of the 3.2 g P/sq m accumulated aboveground was reallocated from belowground plant parts. However, only 23% of this amount returned to belowground in the fall; 2.5 g P/sq m was left on the marsh surface as litter plus leachate. Typha roots continued to absorb P past aboveground senescence and into early winter, resulting in post-shoot-death uptake of up to 9% of the next season's P requirement. Analysis of lakeshore marsh literature via a input-output model suggests that macrophytic translocation of nutrients is an important source of internal loading. In those marshes without major surface water inputs, seasonal accumulation and abandonment of nutrients above the soil interface is likely to be the dominant term in nutrient budgets. (See also W79-09609) (Stihler-Mass)
W79-09622

NUTRIENT DYNAMICS OF NORTHERN WETLAND ECOSYSTEMS,
Michigan Univ., Ann Arbor. School of Natural Resources.
C. J. Richardson, D. L. Tilton, J. A. Kadlec, J. P. M. Chamie, and W. A. Wentz.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 217-241. 2 fig, 6 tab, 96 ref.

Descriptors: *Nutrients, *Wetlands, *Freshwater, *Bogs, Fens, Marshes, Swamps, Nitrogen, Phosphorus, Calcium, Sulfur, Turnovers, Water quality, Vegetation, Rooted aquatic plants, Cation exchange, Productivity, Michigan.

Nutrient information was reviewed for four northern wetland types: fens, bogs, swamps and marshes. Total soil N, P and Ca were lowest in bog peats but Mg content did not vary appreciably among wetland types. Cation exchange capacity was > 100 meq/100 g for all wetlands. Concentrations of N and P in leaves and stems decreased through the growing season in fen plants. Translocation of nutrients from plant parts prior to abcission did not occur. Fen waters were dominated by Ca(++) and HCO3(-) ions; bog waters were dominated by H(+) and SO4(++) ions. Seasonal variations in NH4-N, NO3-N and PO4-P were closely related to peatland hydrology, organism uptake and peat exchange characteristics. For one central Michigan wetland > 97% of the N, P and Ca was in the peat compartment. The turnover time for N in above ground biomass was approximately 2 years. Low productivity in the Michigan fen may be related to low N and P availability. Natural outputs for some wetland types are well within the range, or in some cases exceed, outputs from upland terrestrial ecosystems. The capacity of acid peatlands to store or assimilate additional P or K on a long-term basis appears to be limited. (See also W79-09609) (Stihler-Mass)
W79-09624

SEASONAL PATTERNS OF NUTRIENT MOVEMENT IN A FRESHWATER TIDAL MARSH,
Rider Coll., Trenton, NJ. Dept. of Biology.
R. L. Simpson, D. F. Whigham, and R. Walker.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 243-257. 9 fig, 12 ref.

Descriptors: *Nutrients, *Tidal marshes, *Freshwater, Oxygen, Carbon dioxide, Seasonal, Nitrogen, Phosphorus, Marshes, Wetlands, Rooted aquatic plants, Algae, Ecology, New Jersey.

Tidal action, particularly periodic inundation and flushing, resulted in distinctly different patterns of nutrient distribution in the major wetland habitats. Inorganic N and PO4-P were accumulated in the marsh during summer with emergent vegetation appearing to play an important role in the uptake and retention of nutrients. Although evidence is accumulating that some N and P may be translocated into belowground parts by several perennial macrophytes, most is rapidly leached after death of vascular plants with up to 80% of the total N and even more of the P lost within 1 month. In pond-like areas where filamentous algal blooms develop following the fall dieback of vascular plants, inorganic N and PO4-P levels remain depressed through the winter and spring. On the basis of presently available evidence, it appears almost all habitats of freshwater tidal marshes may be sinks for inorganic N and PO4-P during the vascular plant growing season and that certain habitats may continually function as sinks. (See also W79-09609) (Stihler-Mass)
W79-09625

NUTRIENT DYNAMICS: SUMMARY AND RECOMMENDATIONS,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
I. Valiela, and J. M. Teal.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 259-263. 7 ref.

Descriptors: *Cycling nutrients, *Nutrients, *Wetlands, *Freshwater, Rooted aquatic plants, Hydrology, Microorganisms, Vegetation, Soils, Animals, Research and development, Nitrogen.

Several areas of research must be pursued before nutrient dynamics in freshwater wetlands are clearly understood. Increased emphasis should be placed on hydrology, the role of microorganisms, exchange of nutrients, among wetland components (water, plants, interstitial water, sediments) and the role of animals in nutrient cycling. (See also W79-09609) (Stihler-Mass)
W79-09626

MANAGEMENT OF FRESHWATER MARSHES FOR WILDLIFE,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
M. W. Weller.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. G. Whigham and R. L. Simpson, editors, Academic Press, New York, p 267-284. 4 fig, 79 ref.

Descriptors: *Wetlands, *Freshwater, *Management, *Wildlife, Freshwater marshes, Marshes, Ecology, Ecosystems, Vegetation, Foods, Mammals, Muskrats, Birds, Succession, Habitats, Invertebrates, Economics.

The major objectives of marsh management for wildlife have been to preserve marshes in a natural state and to maintain their productivity. Vegetative patterns strongly influence species composition and size of bird populations. Food resources influence mammals as well as birds. Marshes are in constant change. Throughout the Midwest, water levels and muskrats induce most vegetative changes, and the pattern of vegetation and muskrat and avian responses are predictable in a general way. This short-term successional pattern in marshes can form the basis on which one can establish management procedures. Artificial management practices are discouraged as costly and of short-term value whereas systems based on natural successional patterns produce the most ecologically and economically sound results. (See also W79-09609) (Stihler-Mass)
W79-09627

TIDAL FRESHWATER MARSH ESTABLISHMENT IN UPPER CHESAPEAKE BAY: PONTEDERIA CORDATA AND PELTANDRA VIRGINICA,
Environmental Concern, Inc., St. Michaels, MD.
E. W. Garbisch, Jr., and L. B. Coleman.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. G. Whigham and R. L. Simpson, editors, Academic Press, New York, p 285-298. 3 fig, 3 tab, 29 ref.

Descriptors: *Freshwater marshes, *Chesapeake Bay, *Germination, *Management, *Rooted aquatic plants, Tidal marshes, Wetlands, Vegetation, Mortality, Maryland.

Germination percentages ranged from 93% to 5% for Peltandra virginica and from 20% to 5% for Pontederia cordata with the higher percentages occurring at the high tide elevations. Percentages of seedlings that survived the study period averaged approximately 30% for both species but the surviving seedlings developed poorly. The establishment of these species by seedling is not considered feasible in unsheltered tidal areas. No transplanted 1.5-month-old seedlings of P. virginica survived at the intermediate and low elevations because of wave stress, debris deposition and animal depredation. Those surviving at the high elevation did not develop much beyond their stage at the time of planting. Planting first-year bulbs or second-year seedlings may yield better results for establishing P. virginica in unprotected tidal areas. The survival of 3-month-old seedling transplants of P. cordata was relatively high at all elevations and in all substrate types. Number of flowering stems and standing crop values were significantly greater at lower tidal elevations. It is estimated that a tidal P. cordata marsh exhibiting a first-year aboveground standing crop of 1000 to 4000 kg/ha can be established in the Chesapeake Bay region by plant-

ing seedling transplants on 1- to 0.5-m centers, respectively. (See also W79-09609) (Stihler-Mass)
W79-09628

EFFECTS OF CANALS ON FRESHWATER MARSHES IN COASTAL LOUISIANA AND IMPLICATIONS FOR MANAGEMENT,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
For primary bibliographic entry see Field 6G.
W79-09629

MANAGEMENT OF FRESHWATER WETLANDS FOR NUTRIENT ASSIMILATION,
Wisconsin Univ.-Oshkosh.
For primary bibliographic entry see Field 5D.
W79-09630

MANAGEMENT POTENTIAL SUMMARY AND RECOMMENDATIONS,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
F. Stearns.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 357-363. 7 ref.

Descriptors: *Wetlands, *Freshwater, *Management, Marshes, Freshwater marshes, Decision making, Wastewater, Production, Vegetation, Protection.

Wetland management goals fall in three areas: environmental protection, recreation and aesthetics, and production of renewable resources. Most wetland management, however, is oriented to several goals and most wetlands serve multiple uses. Several general conclusions concerning wetland management can be made at this time: Management decisions should complement natural wetland functions whenever possible. Wastewater should not be applied to natural freshwater wetlands, other than experimentally, until more is known about long-term effects. The rate of wetland conversion should be slowed until more is known about wetland functions. Management should hold to a minimum those factors which degrade marsh structure and function. In creating wetlands, one should remember that plant species differ in their vulnerability to stresses. In modifying wetlands, attempt to avoid disturbance. Natural perturbations may occur and management techniques successful at one point in the climatic cycle may not be applicable at other times. (See also W79-09609) (Stihler-Mass)
W79-09632

DIFFERENTIAL USE OF FRESH WATER ENVIRONMENTS BY WINTERING WATERFOWL OF COASTAL TEXAS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W79-09638

VEGETATION TYPES, SPECIES AND AREAS OF CONCERN, AND FOREST RESOURCES UTILIZATION OF NORTHERN MINNESOTA'S PEATLANDS,
Minnesota Univ., St. Paul. Coll. of Forestry.
V. Kurmis, H. L. Hanson, J. J. Olson, and A. R. Aho.
Prepared for Minnesota Department of Natural Resources, May, 1978. 86 p. 4 fig, 16 tab, 99 ref.

Descriptors: *Wetlands, *Bogs, *Minnesota, *Maps, *Marsh plants, Peat, Plant groupings, Forestry, Distribution patterns.

Information from past vegetative studies of northern Minnesota peatlands are reviewed and organized in the framework of modified existing classification systems. The vegetation types are related to moisture and nutrient conditions in the edaphic field. Plant lists of peatland study areas are used to characterize floristically each vegetation type. Various classifications of rare, endangered, and threatened plant species and their legal status are reviewed. Ten peatland species are considered to be of special concern and are discussed in relation to habitat factors, associated species, and vegetation types. The reported locations are mapped. Proposed or existing scientific and natural areas, critical areas, and National Natural Landmarks are listed. Information was summarized from various sources to assess the possible impact of development of the peatlands on the forest resource and the economy it supports. Relevant information concerns peatland forest area, the tree species and forest types present, and the current industrial use of the forest resource. (Steiner-Mass)
W79-09641

A GUIDE TO PLANTS COMMONLY FOUND IN THE FRESHWATER WETLANDS OF NEW YORK STATE,
Cornell Univ., Ithaca, NY.
T. Rawinski, R. Malecki, and L. Mudrak.
Department of Natural Resources, Community Environment Program, Fernow Hall, Cornell University, Ithaca, New York, 1979. 29 p, 10 ref.

Descriptors: *Marsh plants, *New York, Wetlands, Aquatic plants, Marshes, Bogs, Freshwater marshes.

The plants described are the ones chosen as representative of the various wetland vegetation types by the New York Freshwater Wetlands Act. Each plant genus or species is described in a paragraph which details some of its identifying characteristics. A simple line drawing of one of the species in the genus accompanies each descriptive paragraph. (Steiner-Mass)
W79-09642

AQUATIC AND WETLAND PLANTS OF SOUTHEASTERN UNITED STATES,
Tall Timbers Research, Inc., Tallahassee, FL.
R. K. Godfrey, and J. W. Wooten.
University of Georgia Press, Athens. 1979. 712 p, 397 fig, 61 ref.

Descriptors: *Marsh plants, *Aquatic plants, *Monocotyledons, Southeast US, Wetlands, Rooted aquatic plants, Submerged plants, Floating plants, Amphibious plants, Aquatic weeds, Grasses, Systematics.

Native and naturalized monocotyledonous plants that inhabit aquatic and wetland places, places permanently or seasonally wet, are identified and listed taxonomically. The text for each species includes a statement indicating the habitat or habitats in which the plant usually grows and a statement of its geographic distribution. (Steiner-Mass)
W79-09643

LANDSCAPE EVOLUTION, PEATLAND TYPES, AND THE ENVIRONMENT IN THE LAKE AGASSIZ PEATLANDS NATURAL AREA, MINNESOTA,
North Central Forest Experiment Station, St. Paul, MN.
M. L. Heinselman.
Ecological Monographs, Vol. 40, No. 2, p 235-261, Spring, 1970. 15 fig, 4 tab, 60 ref.

Descriptors: *Bogs, *Succession, *Topography, *Vegetation, *Stratigraphy, Hydrogeology, Sedimentation, Flow characteristics, Water chemistry, Water properties, Chemical stratification, Swamps, Water table, Soil water movement, Mosses, Diversification, Permeability, Groundwater movements, Hydrologic properties, Acidity, Nutrients.

The vegetation and peatland types of the 8,903 hectare Lake Agassiz Peatlands Natural Area are related to topography, waterflow patterns, water chemistry, and the evolution of the land as recorded by peat stratigraphy. Consistent differences in pH, Ca, and Mg were found between waters of the eight contrasting peatland types distinguished. Vegetation types often have sharp boundaries related to changes in water properties, peat surface configuration, and paths of waterflow. Because no contour map was available at a scale adequate for this region of slight relief, a topographic survey was made to do the study. This was accomplished by running 70 miles of level lines with standard differential leveling procedures. The five phases of the evolution of the landscape are described. This history does not agree with early concepts of succession, which postulates a trend toward mesophytism with peat accumulation. The only 'direction' here is a possible trend toward landscape diversity. (Bollinger-Mass)
W79-09644

BRIEF DESCRIPTION OF THE SHOALS IN THE KREMENCHUG RESERVOIR AND THEIR PLANT COVERS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
I. L. Korelyakova.
Hydrobiological Journal, Vol. 11, No. 2, p 7-11, March, 1975. 1 fig, 1 tab, 4 ref.

Descriptors: *Marsh plants, *Ecological distribution, Wetlands, Aquatic vegetation, Marshes, Distribution patterns, Cattails.

A characteristic of the Kremenchug vegetation, like that of other reservoirs of the Dnieper cascade of reservoirs, is the very heterogeneous distribution of phytocenoses. Beds of homogeneous vegetation occupy substantial areas only rarely, except for the large stretches of reeds which have existed before the bogs were inundated. Fairly homogeneous narrow-leaved cattail beds have formed in some places over a considerable area. On the whole, however, the predominance of mixed associations is characteristic of the shoal vegetation. (Steiner-Mass)
W79-09645

THE IMPACT OF MAN ON SEAGRASS SYSTEMS,
National Marine Fisheries Service Beaufort, NC. Atlantic Estuarine Fisheries Center.
For primary bibliographic entry see Field 6G.
W79-09646

PLANT AND INSECT COMMUNITIES IN A MINNESOTA WETLAND,
Minnesota Univ., Minneapolis.
R. K. T. Lammers.
Ph.D. Dissertation, December, 1976. 161 p.

Descriptors: *Wetlands, *Marsh plants, *Aquatic insects, Minnesota, Diptera, Distribution patterns, Aquatic habitats.

Spatial and temporal patterns of emergence were analyzed for the commonest Chironominae and Tanypodinae in a Minnesota wetland. Paratendipes subaerqualis is a specie unique to the swamp forest while Dicrotendipes modestus and D. leucoscelis were present in the sedge mat. The fen was not characterized by any unique species but was composed of several ubiquitous species which occur throughout the wetland. Many of the emergence patterns extend over the entire growing season. Even those species which exhibit emergence peaks usually maintain sustained emergence throughout the season. (Steiner-Mass)
W79-09648

EMERGENT MACROPHYTES OF A WISCONSIN MARSH: PRODUCTIVITY, SOIL-PLANT NUTRIENT REGIMES, AND UPTAKE EXPERIMENTS WITH PHOSPHORUS-32,
Wisconsin Univ.-Milwaukee.
D. S. Lindsley.
Ph.D. Dissertation, May, 1977. 230 p. 28 fig, 27 tab, 104 ref, 2 append.

Descriptors: *Marsh plants, *Productivity, *Nutrients, Wetlands, Wisconsin, Nitrogen, Phosphorus.

Levels of total nitrogen, available phosphorus, and exchangeable calcium in the soil did vary significantly between the Scirpus, Sparganium, and Eleocharis sites. In addition, the seasonal accumulations of all five of the above nutrients by emergent macrophyte populations varied significantly between Sparganium, Scirpus, Juncus, and Sagittaria. Caloric values of the marsh plants all fell

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within 3 to 5 Keal/g. Statistically significant differences exist between ash-free caloric values of shoots and rhizomes of Scirpus and Sparganium but not of Juncus or Saggitaria. Highest caloric values occurred in flowers and fruits. (Steiner-Mass)
W79-09649

CORTICOLOUS EPIPHYTES IN NORTH CENTRAL WISCONSIN BOGS,
Wisconsin Univ.-Madison.
G. Newberry.
Ph.D. Dissertation, August, 1976. 207 p. 58 fig, 32 tab, 88 ref, 2 append.

Descriptors: *Bogs, *Epiphytology, Wetlands, Marsh plants, Vegetation, Environmental effects, Mosses, Habitat, Plants.

Approximately 80% of both the cryptogamic and phanerogamic flora found was made up of the boreal forest element. The cryptogamic flora was a good indicator of microclimatic conditions. Many ecological factors--light and moisture being most significant--determine the distribution of corticolous cryptograms on Larix and Picea. A large number of epiphytes show decided preferences for the bark of Larix over Picea. Shade intolerant species show one or more of the following strategies as the density of the trees on the mat increases; they may be restricted to the upper most sub-lit portions of the bark; they may be common only on young trees; or they may be found only in very low density bogs. The mosses and liverworts were restricted to the basal samples with moisture appearing to be their major limiting factor to their upward mobility. Crustose lichens form large associations of species on the upper twigs and trunk, but become less dominant at the lower sample sites. (Steiner-Mass)
W79-09650

LESSER VEGETATION AS INDICATORS OF VARYING MOISTURE REGIMES IN BOTTOMLAND AND SWAMP FORESTS OF NORTHEASTERN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. School of Forest Resources.
D. M. Flinchum.
Ph.D. Dissertation, 1977. 105 p. 15 fig, 49 tab, 19 ref, 1 append.

Descriptors: *Swamps, *Marsh plants, *Bioindicators, *Soil water, Wetlands, South Carolina, Ecological distribution, Distribution patterns, Soil-water-plant relationships.

The aboveground biomass of the lesser vegetation stratum was most clearly correlated to the number of inundation periods throughout the year. A decrease in the yearly number of inundation periods resulted in an increase of the lesser vegetation biomass. On a wide range of the moisture gradient, the supplejack-Virginia willow combination was the best indicator of available moisture in the form of total inundation days from January through June. The best indicator for the average yearly water table level was the relative frequency of Virginia creeper. An increase in the relative frequency of this species was associated with a decrease in the average yearly water table level measurements. (Steiner-Mass)
W79-09651

SOME EFFECTS OF WATER LETTUCE (PISTIA STRATIOTES, L.) ON ITS HABITAT,
Ghana Univ., Legon. Volta Basin Research Project.
For primary bibliographic entry see Field 2K.
W79-09652

THE ESTUARINE SURFACE MICROLAYER AND TRACE METAL CYCLING IN A SALT MARSH,
Delaware Univ., Newark. Coll. of Marine Studies.
R. E. Pellenbarg, and T. M. Church.
Science, Vol. 203, p 1010-1012, March 9, 1979. 2 fig, 2 tab, 15 ref.

Descriptors: *Salt marshes, *Nutrients, Wetlands, Cycling nutrients, Marshes, Ecology, Copper, Zinc, Iron, Delaware.

The aqueous surface microlayer in a Delaware salt marsh carries an average of 10 percent of the copper, 19 percent of the zinc, and 23 percent of the iron relative to the total metal flux, including the dissolved and seston components. The relative enrichment of trace metals in the surface microlayer of the salt marsh relative to the dissolved components is greater than that observed in more open marine waters. Trace metals cycle in the salt marsh by net import on the surface microlayer and net export in the dissolved and seston components during maximum monthly tides. (Howard-Mass)
W79-09654

THE ROLE OF OVERWASH AND INLET DYNAMICS IN THE FORMATION OF SALT MARSHES ON NORTH CAROLINA BARRIER ISLANDS,
Massachusetts Univ., Amherst. Dept. of Botany.
For primary bibliographic entry see Field 2J.
W79-09656

METHANE EFFLUX FROM LAKE SEDIMENTS THROUGH WATER LILIES,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
J. W. H. Dacey, and M. J. Klug.
Science, Vol. 203, p 1253-1255, March 23, 1979. 1 fig, 1 tab, 10 ref.

Descriptors: *Lakes, *Rooted aquatic plants, *Methane, *Sediments, Wetlands, Michigan, Ecology.

During winter, when water lilies have no surface leaves, the gases in the rhizome lacunae approach equilibrium with the bases of the sediment water. The resulting increase of internal pressure is manifested by the sustained streams of bubbles (up to 37 percent methane and 6 percent carbon dioxide) that escape when emerging leaves are torn in the spring. Methane continues to enter the roots and rhizome during summer, rapidly moves up the petioles, and passes out through the emergent leaves into the atmosphere. (Howard-Mass)
W79-09657

ANALYSIS OF THE PLANT COMMUNITIES OF A HEATHLAND SITE: AYLESBEARE COMMON, DEVON, ENGLAND,
Exeter Univ. (England). Dept. of Biological Sciences.
R. B. Ivimey-Cook, M. C. F. Proctor, and D. M. Rowland.
Vegetatio, Vol. 31, No. 1, p 33-45, December 19, 1975. 6 fig, 2 tab, 27 ref.

Descriptors: *Bogs, *Wetlands, *Vegetation, *Soil properties, *Ecological distribution, England, Distribution patterns.

Species presence-absence data from an area of heath and related vegetation near Exeter, England, have been analyzed using association-analysis, information-analysis and group analysis. The results of the three methods showed substantial agreement; of the three, association-analysis appeared to be the most useful. Of the vegetation types within the area, the dry heath (Calluno-Ulicetalia) and the Pteridium and scrub communities (Rhamno-Prunetea) are rather sharply delimited. The remaining communities intergrade, but may be divided into wet heath and shallow Sphagnum bog (Ericion tetralicis), calcareous Schoema nigricans flushes (Eriophorion latifolii) and a very variable Molinietum (Molinion caeruleae). (Howard-Mass)
W79-09658

ESTUARINE PRODUCTIVITY,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. L. Correll.
BioScience, Vol. 28, No. 10, p 646-650, October, 1978. 2 fig, 41 ref.

Descriptors: *Estuaries, *Primary productivity, *Phytoplankton, *Rooted aquatic plants, Algae, Nutrients, Wetlands, Salt marshes, Organic matter, Ecology, Marshes, Aquatic plants.

The most important primary producers in estuaries seem to be phytoplankton, with submerged vascular plants taking an important but secondary role. Periphyton and benthic thalloid algae provide significant amounts of productivity in shallow water areas. Relatively small amounts of organic matter are transferred to the estuary from tidal marshes and uplands. Estuaries maintain high productivity by maintaining high nutrient levels in bottom sediments and in the water column. This is achieved by nutrient/plankton trapping via the 'salt wedge' countercurrent and the nutrient-modulating actions of tidal marshes, bottom sediments, and submerged vascular plants. (Howard-Mass)
W79-09659

PHLOEM VERSUS XYLEM CONTRACTIONS IN STEMS OF WATER STRESSED TREES,
Iowa State Univ., Ames. Dept. of Engineering Science and Mechanics.
D. B. Johnson, E. A. Baryeth, J. B. Ligon, and C. P. Burger.
Paper No. CA-21, presented at 1978 SESA Spring Meeting, Wichita, Kansas, May 14-19. 17p, 5 fig, 18 ref. Society for Experimental Stress Analysis, Westport, Connecticut. OWRT B-062-IA(2), 14-34-0001-8086.

Descriptors: Phloem, Xylem, Strain gages, *Bark, *Wood, Trees.

Knowledge of the relative importance of bark (Phloem) and wood (Xylem) in daily fluctuations of stem diameter is necessary for the development of a dynamic model of water transport in trees. Data from strain gages mounted directly on bark and wood indicate their relative importance which varies significantly with vertical location on the stem and with water status.
W79-09724

2J. Erosion and Sedimentation

SOME OBSERVATIONS ON THE RELATIONSHIP OF FLOODPLAIN SILTATION TO REED CANARY GRASS ABUNDANCE,
Southeastern Wisconsin Regional Planning Commission, Waukesha.
For primary bibliographic entry see Field 21.
W79-09589

THE ROLE OF OVERWASH AND INLET DYNAMICS IN THE FORMATION OF SALT MARSHES ON NORTH CAROLINA BARRIER ISLANDS,
Massachusetts Univ., Amherst. Dept. of Botany.
P. J. Godfrey, and M. M. Godfrey.
Ecology of Halophytes, p 407-427, 1974. Academic Press Inc., New York, New York. 12 fig, 11 ref.

Descriptors: *Salt marshes, *Islands, *Vegetation establishment, Wetlands, Coastal marshes, North Carolina, Overland flow, Dunes, Inlets(Waterways), Geologic formations.

The present pattern of salt marshes behind the Outer Banks is the result of overwash deposition and inlet dynamics. Oceanic overwash provides sand from the beach during every severe storm, while inlet closure forms new marshes at much longer intervals. Once the inlet is closed, however, marsh formation proceeds rapidly. Both processes are of prime importance and complement each other; submergence of uplands by rising sea level also leads to new salt marshes, but is a more important process on the mainland. Dune lines on the barrier help protect the marshes behind from excessive and continuous overwashes which might overwhelm the ability of the marshes to recover, but they do not stop recession. (Steiner-Mass)
W79-09656

RESISTANCE TO FLOW IN ALLUVIAL CHANNELS WITH COARSE BED MATERIALS,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowa (Poland).
H. Gladki.
Journal of Hydraulic Research, Vol. 17, No. 2, p 121-128, 1979. 2 fig, 1 tab, 14 ref.

Descriptors: *Alluvial channels, *Bed load, *Resistance, Sediment transport, Flow friction, Flow resistance, Hydraulics, Equations, Foreign countries, Foreign research, Rivers, *Poland, *Raba River(Poland), *Coarse bed materials.

The hydraulics of alluvial streams and sediment transport in alluvial channels is not yet well understood and consequently is poorly described. In particular, the topic of flow resistance has received much attention, but as yet there has been no general equation relating friction to average flow velocity. Equations developed on the basis of rigid boundary fluid mechanics do not adequately describe the more complex behavior of alluvial channels. This paper discussed the relationship of flow resistance to average flow velocity based on a study of the Raba River in Poland. Experimental results were compared with Einstein-Barbarossa, Raudkivi and Manning methods. (Lee-ISWS)
W79-09758

VELOCITY MEASUREMENTS DOWNSTREAM OF REARWARD-FACING STEPS, WITH REFERENCE TO BED INSTABILITY,
For primary bibliographic entry see Field 2E.
W79-09759

2K. Chemical Processes

LANDSCAPE EVOLUTION, PEATLAND TYPES, AND THE ENVIRONMENT IN THE LAKE AGASSIZ PEATLANDS NATURAL AREA, MINNESOTA,
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 2I.
W79-09644

NUTRIENT BUDGETS OF APPALACHIAN AND CASCADE REGION WATERSHEDS: A COMPARISON,
Oak Ridge National Lab., TN.
G. S. Henderson, W. T. Swank, J. B. Waide, and C. C. Grier.
Forest Science, Vol. 24, No. 3, p 385-397, September 1978. 2 fig, 6 tab, 24 ref.

Descriptors: *Cycling nutrients, *Water chemistry, *Precipitation chemistry, Leaching, Deciduous forests, Coniferous forests, *Southern Appalachian Mountains, *Cascade Mountains, North Carolina, Oregon, Tennessee.

Precipitation inputs and streamflow outputs of nitrogen, calcium, potassium, magnesium, and sodium were compared for two deciduous forest watersheds and a coniferous forest watershed. While nitrogen inputs varied by nearly tenfold among the watersheds, ammonium and nitrate discharge in streamflow was uniformly small resulting in net accumulation within all three ecosystems. In contrast, cation discharge was more variable among the watersheds than cation input and was strongly related to the bedrock of each watershed. The internal distribution and cycling of nitrogen, potassium, and calcium within each of the three watershed ecosystems was also compared. There were interpretable differences between nutrient cycling patterns in the coniferous and deciduous forests. Overall, however, all three ecosystems were effectively retaining and recycling these nutrients. (Forest Service)
W79-09647

SOME EFFECTS OF WATER LETTUCE (PISTIA STRATIOTES, L.) ON ITS HABITAT,
Ghana Univ., Legon. Volta Basin Research Project.
R. H. Attionu.
Hydrobiologia, Vol. 50, No. 3, p 245-254, September 30, 1976. 6 fig, 5 tab, 11 ref.

Descriptors: *Aquatic plants, *Aquatic habitats, *Environmental effects, Temperature, Dissolved oxygen, Ionic concentrations, Physiochemical properties, Water lettuce, Pistia stratioles, Lake Volta.

Field and laboratory observations show that the growth of Pistia alters markedly the physicochemical condition of its substrate. The nature of this effect on environmental factors such as temperature, dissolved oxygen and pH of Volta Lake is dependent on the density and extent of the vegetative cover. A large and dense mat insulates the water below it against solar radiation and causes stratification and poor oxygenation. The effects of a thin vegetation cover are the opposite of these. In laboratory observations, Pistia grown in culture solutions caused significant changes in the mineral composition of the substrate and changed the pH of the solution from acid to alkaline. These observations support those from the field studies. (Hinkel--Mass)
W79-09652

THE ESTUARINE SURFACE MICROLAYER AND TRACE METAL CYCLING IN A SALT MARSH,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2I.
W79-09654

METHANE EFFLUX FROM LAKE SEDIMENTS THROUGH WATER LILIES,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
For primary bibliographic entry see Field 2I.
W79-09657

ELEMENT CYCLES AND WATER BUDGET ANALYSES APPLIED TO FOREST MANAGEMENT IN THE EASTERN UNITED STATES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-09719

RECENT AND PROJECTED CHANGES IN DEAD SEA LEVEL AND EFFECTS ON MINERAL PRODUCTION FROM THE SEA,
Geological Survey, Nashville, TN. Water Resources Div.
S. P. Sauer.
Geological Survey open-file report 78-176, 1978. 43 p, 5 fig, 1 tab, 36 ref.

Descriptors: *Sea water, *Salinity, *Water levels, *Inflow, *Evaporation, Hydrology, Hydrologic data, Water chemistry, Hydrologic budget, Dissolved solids, Arid lands, Reviews, Evaluation, *Dead Sea, *Jordan, *Israel, *Jordan River.

Hydrologic data for the Dead Sea area were reviewed to assess the probable magnitude and rate of change of the water level of the Sea. Historical average annual Dead Sea levels range from a minimum of 399.4 meters below sea level in about 1818 to a maximum of 388.6 meters below in 1896. Present levels are rapidly approaching the historical low. There is a close correlation between Dead Sea level and accumulated departure from the mean of long-term rainfall except for the most recent period since 1964. During that period rainfall has been near the long-term average but water levels have continued to decline, in part due to abstractions for irrigation in the Jordan River basin. The dissolved-solids concentration of Dead Sea water presently is approximately 322,000 milligrams per liter and is generally well mixed. The increase in dissolved solids to the present high concentration has resulted in an evaporation rate less than that estimated in previous reports. An average annual inflow to the Sea of 900 cubic hectometers from all sources is required to stabilize the Sea at the present level. (Woodard-USGS)
W79-09729

GROUND-WATER BASIC DATA FOR MCINTOSH COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-09737

GROUND-WATER RESOURCES OF DUNN COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-09740

EFFECT OF SELECTED GEOLOGY-SOIL COMPLEXES ON WATER QUALITY OF THE LITTLE BLACK FORK CREEK,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 5G.
W79-09800

2L. Estuaries

THE IMPACT OF MAN ON SEAGRASS SYSTEMS,
National Marine Fisheries Service Beaufort, NC. Atlantic Estuarine Fisheries Center.
For primary bibliographic entry see Field 6G.
W79-09646

THE ESTUARINE SURFACE MICROLAYER AND TRACE METAL CYCLING IN A SALT MARSH,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 2I.
W79-09654

MICROHETEROTROPHIC ACTIVITY IN A SALT-MARSH ESTUARY, SAPELO ISLAND, GEORGIA,
Skidaway Inst. of Oceanography, Savannah, GA.
R. B. Hanson, and J. Snyder.
Ecology, Vol. 60, No. 1, p 99-107, 1979. 2 fig, 9 tab, 42 ref.

Descriptors: *Salt marsh, *Marine bacteria, *Kinetics, *Organic matter, Bacteria, Wetlands, Georgia, Sapelo Island, Microorganisms, Aquatic microorganisms, Respiration, Estuaries.

Radioactive glucose was used to estimate maximum potential uptake kinetics in unfractionated and screened water samples. Most of the estuary activity was found in the size fraction > 10 micrometers, in the summer, and in the tidal creeks. The uptake of labeled lactic acid was greater than glucose, glycolic acid, aspartic acid, and alanine. Glycolic acid was respired most rapidly, followed by aspartic acid, lactic acid, alanine and glucose. Most of the particulate organic carbon, ATP, and platable bacterial cells were in the 10 micrometer fraction. Glucose uptake values were significantly correlated with ATP and platable bacterial cells, and lactic acid uptake values with platable bacterial cells only. Uptake and turnover times in the unfractionated water were 57% lower and 29% greater, respectively, than in the < 64 micrometer fraction sample, and potassium and tin values were at times very dissimilar among fractions of the same water. These results were attributed to the physical separation of the plankton community, nutrient fluctuation in the sample, and microheterotroph diversity and distribution on particles. (Steiner-Mass)
W79-09655

THE ROLE OF OVERWASH AND INLET DYNAMICS IN THE FORMATION OF SALT MARSHES ON NORTH CAROLINA BARRIER ISLANDS,
Massachusetts Univ., Amherst. Dept. of Botany.
For primary bibliographic entry see Field 2J.
W79-09656

ESTUARINE PRODUCTIVITY,

LIBRARY U. OF I. URBANA - CHAMPAIGN

Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2I.
W79-09659

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1973-SEPTEMBER 1974,
Geological Survey, Houston, TX. Water Resources Div.
W. B. Lind, and K. W. Ratzlaff.
Texas Department of Water Resources Report 231, May 1979. 217 p, 13 fig, 10 tab, 11 ref.

Descriptors: *Chemical properties, *Physical properties, *Water quality, *Estuaries, *Texas, Data collections, Sampling, Sites, Water analysis, Chemical analysis, Organic compounds, Inorganic compounds, Trace elements, Nutrients, Insecticides, Bacteria, Coliforms, Chlorophyll.

Data collections were made at approximately 400 sites in estuaries of Texas during the 1974 water year. At each data-collection site, field data were collected from several points along a vertical. Samples for laboratory analyses were collected from a predetermined number of data-collection sites and at other sites in the network when significant changes in field data indicated a need for additional samples. Properties or constituents measured in the field were dissolved oxygen, specific conductance, temperature, pH, transparency by Secchi disk, and turbidity. Laboratory analysis included the principal inorganic ions, biochemical oxygen demand (BOD), phenol, total organic carbon (TOC), chlorophyll, coliform and streptococci bacteria, insecticides and herbicides, ammonium, nitrite, nitrate, ortho and total phosphate, and several other selected ions such as aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, nickel, strontium, and zinc. (Woodard-USGS)
W79-09743

CAROLINA BAYS ON THE EASTERN SHORE OF VIRGINIA,
Soil Conservation Service, Smithfield, NC.
D. J. Bliley, and D. E. Pettry.
Soil Science Society of America Journal, Vol. 43, No. 3, p 558-564, May-June 1979. 5 fig, 4 tab, 21 ref.

Descriptors: *Soils, *Virginia, *Geomorphology, *Soil structure, Soil surfaces, Coasts, Shores, Remote sensing, Infrared radiation, Surveys, Depression, Soil types, Sands, Silts, Clays, Soil science, *Carolina bays.

Carolina bays were analyzed on the Eastern Shore of Virginia utilizing infrared imagery and pedologic techniques. Over 160 bays were delineated, thus indicating that they are major landforms in the area. Bays differed from those reported in other regions by being less elliptical, more westerly oriented, and lacking well-developed rims in any specific quadrant. Bay location and size are apparently controlled by landscape and sandy parent materials as evidenced by association with less distinct natural depressions with similar orientation as the related geomorphic surface. Soils on bays of recent surfaces have weaker profile development compared to Pleistocene upland bays. More than one period of bay formation is suggested by differential pedogenic development and geomorphic positions. Data indicated Carolina bays were formed by the alteration of poorly drained areas on undissected Coastal Plain interfluves. Wind and waves were suggested as factors in bay formation based on well-sorted sands of elevated rims, 'dune-like' character, and silt content of possible aeolian origin. (Sims-ISWS)
W79-09769

SOIL-LANDSCAPE RELATIONSHIPS ON THE TIDAL MARSHES OF MARYLAND,
Maryland Univ., College Park. Dept. of Agronomy.
R. G. Darmody, and J. E. Foss.
Soil Science Society of America Journal, Vol. 43, No. 3, p 534-541, May-June 1979. 6 fig, 5 tab, 17 ref.

Descriptors: *Tidal marshes, *Maryland, *Soils, *Vegetation, Marshes, Coastal marshes, Tidal waters, Coasts, Shores, Soil types, Surveys, On-site investigations, Salinity, Conductivity, Electrical conductivity, Sulfur, Organic matter, Geomorphology, Estuaries, Soil science.

A study was conducted to investigate and model the soil-landscape relationships represented in the 87,000 ha of tidal marsh in Maryland. Models were presented for three physiographic marsh landscapes: coastal, estuarine, and submerged upland. Coastal marshes, about 8% of the total marsh area, have formed in the lagoons behind coastal barrier islands. The associated soils are primarily Sulfaquents and Sulfihemists. Estuarine marshes, 38% of the total, have formed from recent accumulation of sediments in stream channels and estuarine meanders. The majority of the associated soils are Sulfaquents, Sulfihemists, and Hydraquents. Submerged upland marshes are the most extensive, covering an estimated 54% of the total. These marshes have formed as a result of the inundation of low-lying uplands by rising sea level. It appears that the soils were formerly Aquults and, because of submergence, they have become Histic Halaqualfs (proposed) and Sulfihemists. (Sims-ISWS)
W79-09772

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3F. Conservation In Agriculture

THE USE OF SALINE WATER FOR IRRIGATION IN THE U.S.S.R.,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. B. Bessler.
Final Report August 1979. In accordance with the U.S.-U.S.S.R. Joint Commission on Scientific and Technical Cooperation-Water Resources. 141 p, 9 fig, 52 tab, 11 ref.

Descriptors: *Saline water, *Irrigation, *USSR, Agriculture, Leaching, Mineralogy, Salt tolerance, Water quality, Reclaimed water, Crop production, Irrigation systems, Irrigation practices, Irrigation effects.

A compilation of 11 translated Russian documents related to the advanced use of saline water for irrigation is presented. During 1976-78 a U.S. interagency team, the U.S. Irrigation Water Quality Team, examined the status of irrigation water quality in the U.S.S.R. During visits to both countries and in formal exchanges of technical data, the general interest information that is presented was developed. The Soviet government is presently engaged in a large-scale land reclamation program that is bringing in new lands under irrigation at the rate of about 1 million hectares per year. Land reclamation measures include: land preparation, leaching, improved irrigation and water application systems, and drainage networks. Increased use is being made of saline lands and saline water to extend limited water supplies. Discussions are presented providing Soviet viewpoints regarding successful use of saline water in various irrigation application and an analysis of related short-term and long-term consequences and impacts. A major problem, the difficulty in regulating the salt conditions in irrigated soil, is emphasized since the problem of avoiding soil salinization using fresh water has not even been solved. (Seigler-IPA)
W79-09666

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

USE OF FLUVIAL PROCESSES TO MINIMIZE ADVERSE EFFECTS OF STREAM CHANNELIZATION,
North Carolina Univ. at Charlotte. Dept. of Geography and Earth Sciences.
N. R. Nunnally, and E. Keller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 934, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute of The University of North Carolina. UNC-WRRI Rpt. No. 144, July 1979, 115 p. 41 fig, 8 tab. OWRT B-089-NC(8). 14-34-0001-6103.

Descriptors: *Channel morphology, Channel improvement, Bank stability, Fluvial sediment, Sediment control, Urban streams, Channelization, Channel restoration.

Stream restoration is a means for restoring flow efficiency in streams that have become debris-choked and eroded due to the direct or indirect actions of humans. Such degraded streams are typically characterized by debris jams, severe bank erosion, over-wide channels, and heavy sediment discharge brought on by altered stream regimes, land use changes or prior channelization. Compared to channelization, stream restoration involves trading off some loss in flow efficiency for a more stable channel morphology and significantly better aquatic and fluvial ecosystems. Stream restoration is accomplished by removing debris jams and providing fairly uniform channel cross-sections and gradients while preserving meanders, leaving as many trees as possible along stream banks, and stabilizing banks with vegetation and riprap where necessary. Economically, the cost of restoration is typically less than one-tenth of the cost of channelization. Experiments with stream restoration on Briar Creek, Gum Branch and Mallard Creek in Charlotte, North Carolina, have been extremely successful. Despite several storms with heavy rainfall, some of which exceeded ten-year design storms, few significant areas of bank failure have occurred in the restored sections even though massive failures occurred during the same period on untreated streams nearby. Public enthusiasm and support for the project is very high with most residents of flood prone neighborhoods perceiving considerable improvement in flood hazards and reduced erosion without significant reduction in wildlife.
W79-09672

MODELING THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PRODUCTION PONDS,
Auburn Univ., AL.
R. P. Romaire.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 906, Price codes: A07 in paper copy, A01 in microfiche. Ph.D. Dissertation, March 1979, 93 p, 9 fig, 25 tab. OWRT A-066-ALA(3).

Descriptors: Plankton, *Turbidity, Secchi disk, *Channel catfish, *Ponds, Dissolved oxygen, Mathematical models, Chemical oxygen demand.

Consumption of O2 by planktonic communities of pond waters may be predicted from chemical oxygen demand (COD) and water temperature (R2 = 0.85). In ponds where plankton organisms are the major source of turbidity, Secchi disk visibility may also be used to estimate COD (r2 = 0.81) or consumption of O2 by planktonic communities (R2 = 0.82). A mathematical model for simulating nighttime decline in dissolved oxygen (DO) concentrations was developed for channel catfish ponds. This model incorporated data on plankton respiration from the present study, data from the literature on respiration by channel catfish, respira-

tion by benthic organisms, and O2 diffusion. The model was validated for six catfish ponds. Measured and simulated DO concentrations at dawn usually agreed within + or - 10%. Secchi disk visibility determinations should be used in the computer simulation to estimate O2 consumption by plankton whenever possible. However, COD values may be used when ponds contain appreciable clay turbidity. Tables were prepared which give the minimum acceptable Secchi disk visibility and the maximum permissible COD which may be tolerated in a particular pond without danger of DO depletion during the night. These tables will be useful to fish pond managers.
W79-09721

4C. Effects On Water Of Man's Non-Water Activities

PRESERVING WETLANDS IN NORTHEASTERN ILLINOIS,
Illinois Nature Preserves Commission, Rockford.
G. A. Paulson.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 116-120. (1978) 4 fig.

Descriptors: *Wetlands, *Protection, *Illinois, Marshes, Bogs, Wildlife, Plants, Aquatic life.

Almost every tamarack bog in Illinois has been acquired and saved while most marshes go unprotected. This is a statement of the importance of the press appeal and public support generated by bogs but not by marshes. It also helps to find a rare or endangered orchid or other pressworthy plant or animal living in the area. In northeastern Illinois there has been a lack of any effort by Governmental agencies to do much to protect wetlands before they are threatened. (See also W79-09581) (Stihler-Mass)
W79-09591

EFFECTS OF SURFACE MINING ON HYDROLOGY, EROSION, AND SEDIMENTATION IN EASTERN KENTUCKY,
Northeastern Forest Experiment Station, Berea, KY.
W. R. Curtis.
In: Fourth Kentucky Coal Refuse Disposal and Utilization Seminar. June 6-7, 1978. Pineville, Kentucky. Sponsored by University of Kentucky College of Engineering, Lexington, Kentucky. p 17-19, 8 ref.

Descriptors: *Strip mines, *Hydrology, *Erosion, *Sedimentation, Eastern Kentucky.

Research by the U.S. Forest Service Unit at Berea, Kentucky has shown that surface mining results in increases in storm peak flows during and immediately after mining but that peaks may be significantly lower after reclamation is completed. Impoundments on surface mine lands can be effective in controlling runoff and erosion provided the ponds are properly constructed. Erosion and subsequent sedimentation are greatest during early stages of mining but diminish rapidly as the land is reclaimed and vegetation growth progresses. (Forest Service)
W79-09623

PEAT UTILIZATION AND THE RED LAKE INDIAN RESERVATION.
Butler (Walter) Co., St. Paul, MN.
For primary bibliographic entry see Field 2H.
W79-09634

HYDROLOGIC ASPECTS OF SURFACE MINING IN THE EAST,
Northeastern Forest Experiment Station, Berea, KY.
W. R. Curtis.
In: Proceedings 1977 Annual Meeting of the Society of American Foresters, Albuquerque, New Mexico, October 2-5, 1977. p 152-157, 20 ref.

Descriptors: *Strip mines, *Water quality, *Erosion, *Sedimentation, Peak flows, Groundwater, Water yield, Infiltration, Surface storage, Eastern United States.

The hydrology of surface mined land is compared to that of unmined forested land. Surface mining results in drastic land disturbance in comparison to forest timbering activities. Hydrology may be adversely affected due to mining activities. On the other hand there is some evidence that desirable changes may be effected due to changes in potential detention and retention storage capacities. (Forest Service)
W79-09639

THE IMPACT OF MAN ON SEAGRASS SYSTEMS,
National Marine Fisheries Service Beaufort, NC. Atlantic Estuarine Fisheries Center.
For primary bibliographic entry see Field 6G.
W79-09646

USE OF FLUVIAL PROCESSES TO MINIMIZE ADVERSE EFFECTS OF STREAM CHANNELIZATION,
North Carolina Univ. at Charlotte. Dept. of Geography and Earth Sciences.
For primary bibliographic entry see Field 4A.
W79-09672

EFFECT OF HARVESTING SYSTEMS ON WATER QUALITY AND SUPPLY,
Southern Forest Experiment Station, Oxford, MS. Forest Hydrology Lab.
S. J. Ursic.
In: Complete Tree Utilization of Southern Pine Symposium Proceedings, New Orleans, LA, April 1978, p 103-107. Edited by Charles W. McMillin. Forest Products Research Society, Madison, Wisconsin.

Descriptors: *Water quality, *Water yield, *Harvesting, Water supply, Clearcutting, Pine trees, Coastal plains, Forest management, *Complete-tree utilization, Complete-tree harvesting, *Regeneration, *Harvesting methods, Physical water quality, Chemical water quality, Interception, Southern pinery.

Over much of southern pinery, clearcutting can increase first-year water yields about 50 percent. Compared to conventional harvesting, complete-tree harvesting will not significantly alter such change. Changes in physical and chemical water quality result less from removal of the biomass than from disturbances to the soil and forest floor during harvest. The leading cause of pollution of streams draining southern forest lands is mechanical site preparation, and complete-tree harvesting can reduce or even eliminate its use. (Forest Service)
W79-09751

4D. Watershed Protection

TIMBER HARVESTING PRACTICES AND WATER QUALITY IN THE EASTERN UNITED STATES,
Northeastern Forest Experiment Station, Pennington, NJ.
E. S. Corbett, J. A. Lynch, and W. E. Sopper.
Journal of Forestry, Vol. 76, No. 8, p 484-488, August, 1978.

Descriptors: *Water quality, *Nutrients, *Water temperature, *Turbidity, *Aquatic environment, Sedimentation, Watershed management, Clearcutting, Erosion, Trout, *Buffer strips, *Timber harvesting, *Best management practices, Logging management, Nonpoint source pollution.

Data from forested experimental watersheds in the eastern United States indicate that leaching of nutrients after timber harvesting, especially clearcutting, tends to increase from south to north, while increases in streamwater temperature and sediment loadings tend to decrease. Concentrations of nutrients in streamwater are highest where revegetation of cutover areas is delayed. Also, increased streamwater temperature (in addition to increased light) caused by exposing stream channels may influence water quality by affecting a wide range of physical, chemical, and biologic processes. Soil erosion losses from harvesting operations can be kept to acceptable levels by following available land-management guidelines, and with supervision by qualified foresters. Buffer strips, in which only light selection cutting is allowed, will help minimize sedimentation as well as nutrient leaching and stream temperature increases. (Forest Service)
W79-09590

HYDROLOGIC ASPECTS OF SURFACE MINING IN THE EAST,
Northeastern Forest Experiment Station, Berea, KY.
For primary bibliographic entry see Field 4C.
W79-09639

A SYNOPTIC APPROACH FOR ANALYZING EROSION AS A GUIDE TO LAND-USE PLANNING,
Geological Survey, Menlo Park, CA. Water Resources Div.; and Geological Survey, Portland, OR. Water Resources Div.
W. M. Brown, III, W. G. Hines, D. A. Rickert, and G. L. Beach.
Available from Branch of Distribution, USGS 1200 S. Eads St., Arlington, VA 22202. Geological Survey Circular 715-L, 1979. 45 p, 24 fig, 1 plate, 7 tab, 33 ref.

Descriptors: *Erosion, *Land use, *River basins, *Synoptic analysis, *Oregon, Erosion rates, Mapping, Rill erosion, Forecasting, Land management, Planning, Remote sensing, Aerial photography, Erosion control, Evaluation, *Erosion potential, *Erosional-depositional province map, Erosional-impact matrix.

A synoptic approach has been devised to delineate the relationships that exist in a river basin between physiographic factors, land-use activities, and resultant erosional problems. The approach involves the development of an erosional-depositional province map, the identification and mapping of existing erosional and depositional features, and the formulation of a numerical matrix for rating the potential for erosional problems. The map and matrix tools are presently being used by the State of Oregon to assess the impact of land-management practices on water quality. (Woodard-USGS)
W79-09730

EFFECTS OF CONVERTING SAGEBRUSH COVER TO GRASS ON THE HYDROLOGY OF SMALL WATERSHEDS AT BOCO MOUNTAIN, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
G. C. Lusby.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.75. Geological Survey Water-Supply Paper 1532-J, 1979. 36 p, 15 fig, 1 plate, 5 tab, 7 ref.

Descriptors: *Sediment control, *Runoff, *Vegetation effects, *Grassed waterways, *Watershed management, Soil conservation, Small watersheds, Sagebrush, Brush control, Range management, Water yield, Storm runoff, Snowmelt, Sediment yield, Evaluation, *Colorado, Boco Mountain(CO), Vegetation conversion.

Changes in runoff and sediment yield caused by changing sagebrush cover to grass cover were studied at four small watersheds in western Colorado during a 9-year period from 1965 to 1973. Measurements of runoff and sediment yield from the four watersheds were made for 3 years, at which time two watersheds were plowed and seeded to beardless bluebunch wheatgrass. The same measurements were then continued for an additional 6 years. Measurements indicated that conversion to grass caused a reduction in runoff from summer rainstorms of about 75 percent. Runoff from spring snowmelt increased about 12

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percent, and annual runoff from treated watersheds decreased about 20 percent when compared to control watersheds. Sediment yield from the seeded watersheds was reduced by about 80 percent; most of this reduction is related to the decrease in runoff from summer rainstorms. The size of barren interspaces between plants was reduced on the converted watersheds to about 30 percent of those on the untreated watersheds. Linear regression analysis indicates that a reduction of 38 percent in the amount of bare soil resulting from planting grass would result in a decrease of 73 percent in sediment concentration. (Woodard-USGS)
W79-09732

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SUSPENDED PARTICULATE MATTER IN THE NEW YORK BIGHT APEX: OBSERVATIONS FROM APRIL 1974 THROUGH JANUARY 1975,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
T. A. Nelsen.
NOAA Technical Memorandum ERL MESA-42, May 1979. 81 p, 39 fig, 1 tab, 13 ref, 10 append.

Descriptors: *Water quality, *Pollutant identification, Geochemistry, Waste disposal, *Outer Continental Shelf, *New York bight, Ocean dumping, Suspended particulate matter.

Suspended particulate matter (SPM) concentration, distribution, and composition in the New York Bight apex was studied. This report covers SPM data for the period April 1974 through January 1975, and extends the time series initiated in 1973. Suspended particulate matter in the New York Bight apex can be broadly classified as natural and anthropogenic. Natural sources include the mineral and biological components of river runoff, plankton, eolian sources, resuspended bottom sediments, and material advected into the apex by continental shelf currents. To this natural particulate matrix man introduces a complex mixture of particles derived from dredged materials, construction debris, sewage sludge, and industrial acid waste material. Observations reported here were taken on cruises separated by approximately one month and designated as Water Column Characterization (WCC) cruises. (NOAA)
W79-09661

USE OF INDICATOR SPECIES OF ALGAE TO DETERMINE WATER QUALITY,
Connecticut Univ., Storrs. Inst. of Water Resources.
F. R. Trainor, and P. A. Siver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 953, Price codes: A03 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 26 p, 12 fig, 3 tab, 14 ref. OWRT B-011-CONN(1). 14-34-0001-7146.

Descriptors: Algae, *Bioindicators, *Bioassay, *Scenedesmus, Nutrients, Light intensity, Temperature, Nitrogen, Ammonium compounds, Phosphorus, Sodium, Heavy metals.

Scenedesmus strain 170 formed unicells in response to nitrogen, primarily as ammonium. The response was due to large uptake pulses of nitrogen. Source of nitrogen, cell pretreatment, nutrition, light intensity and temperature all affected nitrogen uptake, and the resulting unicell percentages. Triggering of the unicellular stage is a complex process involving a variety of factors. The sensitivity of the morphological response, i.e., control of the unicellular stage, to many factors in addition to nitrogen made use of Scenedesmus 170 questionable for an assay for nitrogen. A second Scenedesmus, AP 1, was studied in the laboratory and field. Colonies formed in older Bristols cultures, or in densely populated young cultures. With a low cell density unicells developed. Growth of AP 1 in the laboratory in pond water or in the field itself resulted in a colonial population at all cell densities. The organism is unsuitable for lab assays of field conditions. Based on these and other data it is concluded that certain algae might be used as indicator organisms only with precise control of several physical factors and many aspects of their nutrition.
W79-09674

HYDROLOGIC DATA FOR THE COAL RIVER BASIN, WEST VIRGINIA,
Geological Survey, Morgantown, WV. Water Resources Div.
F. O. Morris, J. S. Bader, J. L. Chisholm, and S. C. Downs.
West Virginia Geological and Economic Survey Basic Data Report No. 5, 1976. 215 p, 11 tab.

Descriptors: *Hydrologic data, *Surface water availability, *Groundwater resources, *Water quality, *Mine drainage, Coal mines, Data collections, Sampling, Water analysis, Streamflow, Sediment transport, Water wells, Water yield, Well data, Chemical analysis, Flow characteristics, West Virginia, *Coal River basin.

During 1973-1975, the U.S. Geological Survey collected hydrologic data to describe the character of the ground- and surface-water resources of the Coal River basin in southern West Virginia. Streamflow and chemical, physical, and biological data were collected at about 15 stream sites. Descriptive data were collected at about 450 well sites and water samples from nearly 400 of them were analyzed for chemical and physical properties. The chemical composition of surface water at the time of low flow and moderate flow was determined for about 115 small streams. (Woodard-USGS)
W79-09745

FACTORS INFLUENCING PH IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goteborg.
C. Brosset.
Water, Air, and Soil Pollution, Vol. 11, No. 1, p 57-61, January 1979. 2 fig, 3 tab, 1 ref.

Descriptors: *Lakes, *Water quality, *Hydrogen ion concentration, *Mathematical model, Acids, Analysis, Analytical techniques, Humic acids.

Using an improved titration technique, Lee and Brosset have established the presence in a number of lake waters of an acid with k sub alpha = 0.0003. It was shown in this paper that higher concentrations of this acid, which seems to correspond to a functional group of humus, may under certain conditions drastically contribute to the lowering of pH of lake water. (Humphreys-ISWS)
W79-09756

A REVIEW OF SURVIVAL RATES OF FISH EGGS AND LARVAE IN RELATION TO IMPACT ASSESSMENTS,
NUS Corp., Pittsburgh, PA. Northern Environmental Services Div.
M. D. Dahlberg.
Marine Fisheries Review, Vol. 41, No. 3, p 1-12, 1979. 4 tab, 6 fig, 111 ref.

Descriptors: *Reviews, *Fish eggs, *Survival rates, *Larval growth stage, *Aquatic populations, *Marine fish, Walleye, Striped bass, Commercial fish, Anadramous fish, Salmon, Bibliographies, Data collections, Immature growth stage, Growth stages, Mortality, Salmonids, Fish behavior, Environmental effects, Freshwater fish.

Enormous fecundities of fishes are balanced by high egg and larval mortalities resulting from natural interacting environmental stresses. Survival rates generally increased inconsistently with age of eggs and larvae. Few published studies provided the data needed to compare relative mortality among the three major developmental stages. Mortality was greatest during the egg stage in the walleye and striped bass, but during the postlarval stage in some marine species. Wide ranges of egg survival for Atlantic Herring, northern pike, rainbow smelt, and walleye depend on whether egg production is based on fecundity or field counts, and whether survival is measured to a stage of drifting larvae or late eggs. Among freshwater species, hatching success was low in unprotected eggs and high in species which exhibit parental care, construct nests, but do not exhibit parental care, have special protective mechanisms (yellow perch), and apparently in species which deposit eggs in vegetation. Among anadromous species, egg survival in striped bass was particularly low in comparison to that in salmon. In the sea, hatching success of demersal eggs was much higher than in pelagic eggs. Survival of yolk-sac larvae was generally higher in marine and freshwater species than in anadromous species. Survival of postlarvae was highest in freshwater species in relation to high daily survival rates and short developmental periods. (D. Katz-EIS)
W79-09773

EFFECT OF A TROPICAL SWAMP ON WATER QUALITY,
Nairobi Univ. (Kenya). Dept. of Botany.
J. J. Gaudet.
Verhandlungen internationale vereiniging fur theoretische und ungewandte limnologie, Vol. 20, Part 4, p 2202-2206, 1978. 3 fig, 1 tab, 13 ref.

Descriptors: *Water quality, *Domestic wastes, *Swamp, Nutrients, *Sewage disposal, Salinity, Seasonal, Sediments, Papyrus, Algae, Swamp plants, Sodium, Potassium, Calcium, Magnesium, Chloride, Silicon, Uptake, Accumulation, Tropical swamp, Tropics, Papyrus swamp.

A papyrus swamp may be effective in removal of organic nutrients from sewage effluents directed into these swamps, but will have little effect on the salt content of the effluent if the discharge is at a high rate. Water samples collected from a floating papyrus swamp show a decrease in major ions on the swamp bottom during the period August - December. Papyrus takes up and accumulates considerable amounts of the major ions. (Katz-EIS)
W79-09775

EFFECT OF CALCIUM IN WATER ON PHOSPHORUS METABOLISM IN FISH TISSUES,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. D. Solomatina.
Hydrobiological Journal, Vol. 14, p 78-81, 1978. 1 fig, 19 ref.

Descriptors: *Calcium, *Absorption, *Metabolism, *Phosphorus, *Sublethal effects, Biochemistry, *Enzymes, *Inhibitors, Organophosphorus, Compounds, Carp, Bioassay, Laboratory tests, Energy, Respiration, Fish physiology, Tissue analysis.

The effects of calcium concentrations of 60, 200, and 500 mg/liter on ATP production and ATPase and alkaline phosphatase activity in fish tissues are presented. Synthesis of ATP and ADP were not hindered at calcium concentrations of 60 or 200 mg/liter. Calcium concentrations to 500 mg/liter suppressed energy-generating processes in fish organs, specifically in the gill tissue of Carassius carassius where the ATP content dropped steadily despite high concentrations of ADP which stimulates respiration. Activity of Ca(+2)-activated, Mg(+2)-dependent ATPase and alkaline phosphatase in carp tissues varies markedly under the influence of calcium ions. The activity of both enzymes decreases in gills at 60 mg Ca/liter. Alkaline phosphatase activity in liver tissue is unchanged at this concentration of calcium while ATPase activity decreases. It is known that calcium salts can combine with the activity center of ATPase and suppress its activity. This experiment indicates the vital role that the gills have in the transport of calcium ions. (D. Katz-EIS)
W79-09776

INFLUENCE OF DISPERSANTS ON THE EMBRYONIC DEVELOPMENT OF THE SEA URCHIN STRONGLYOCENTROTUS NUDUS,
Akademiya Nauk SSSR, Vladivostok. Inst. Morskogo Biologii.
M. A. Vashchenko.
The Soviet Journal of Marine Biology, Vol. 4, No. 5, p 848-853, 1978. 2 tab, 11 ref.

Descriptors: *Dispersants, *Sea urchins, *Embryonic growth stage, *Toxicity, *Oil spills, Invertebrates, Bioassay, Laboratory tests, Sublethal effects, Dispersion, Growth stages, Corexit, DN-75, Water pollution effects, Methodology, Reproduction, Fertilization, Stronglyocentrotus, Oil wastes, Oil pollution.

Two dispersants, the foreign-made Corexit and locally produced DN-75, were tested for their effect on the embryonic development of the sea urchin Strongylocentrotus nudus. The dispersants were administered in concentrations of 0.01 to 10.0 g/liter. Selected as control stages were fertilization, cleavage, blastulation, gastrulation, and the appearance of plutei. The discernible disruptions occuring in embryogenesis at the concentration of 1.0 g/liter accelerated with the increase of the concentration. The concentration of 10.0 g/liter completely inhibited embryogenesis. Development of the embryo in experiments at concentrations of 0.5, 0.1, and 0.01 g/liter was indistinguishable from that of the control. There were no substantial differences revealed between the effect of the two dispersants on embryonic development. The author concludes that the toxicity of the dispersants is low and that DN-75 is suitable for the control of oil film. (D. Katz-EIS)
W79-09777

SALINITY STRESS IN HARPACTICOID COPEPODS,
Delaware Univ., Lewes. Marine Studies Complex.
C. M. Finney.
Estuaries, Vol. 2, No. 2, p 132-135, 1979. 11 ref.

Descriptors: *Intertidal areas, *Copepods, *Salinity, *Stress, *Respiration, *Dormancy, *Adaptation, Immature growth stage, Aquatic animals, Environmental effects, Tigriopus, Tachidius, Tisbe, Saline water, Water quality, Habitats, Invertebrates, Zooplankton, Laboratory tests, Dehydration.

Three species of intertidal harpacticoid copepods, Tigriopus japonicus, Tachidius brevicornis and Tisbe sp., were tested for their response to salinities ranging from 0 ppth to 210 ppth. At 90 ppth Tigriopus became dormant, but could be reanimated if placed in 30 ppth seawater within 18 hours. Tachidius became dormant at 60 ppth but could also be revived if placed in 30 ppth seawater. Tisbe died shortly after an exposure to seawater of 45 ppth. Death was brought about in Tigriopus and Tachidius by salinities of 150 ppth. Naupliar, copepodite, and adult stages of Tigriopus withstood the salinities equally well, while egg sacs could tolerate five times the length of exposure of these stages. The respiratory rate of Tigriopus was 3.76 micro l O2/hr/mg dry wt for active adults and 0.03 nl O2/hr/mg dry wt for adults in the dormant state. The duration of dormancy, with successful revival, appears to be limited to the time before the loss of the vital water content of the tissues due to the high osmotic pressure. The ability to enter dormancy in times of stress may have high survival value to some intertidal copepods. (Katz-EIS)
W79-09778

AQUIL: A CHEMICALLY DEFINED PHYTOPLANKTON CULTURE MEDIUM FOR TRACE METAL STUDIES,
Massachusetts Inst. of Tech., Cambridge. Aquatic Research Lab.
F. M. M. Morel, J. G. Rueter, D. M. Anderson, and R. R. I. Guillard.
Journal of Phycology, Vol. 15, p 135-141, 1979. 3 tab, 1 fig, 33 ref.

Descriptors: *Trace metals, *Aquiculture, *Phytoplankton, *Aquil, *Culture media, *Formulation, *Bioassays, *Nutrients, Aquatic plants, Laboratory tests, Diatoms, Defined media, Toxicity, Water quality, Water properties, Thermodynamics, Methodology, Plant growth, Salinity, Freshwater, Chemical analysis.

The medium Aquil and its variations have been successfully used for trace metal studies of marine phytoplankton (diatoms and dinoflagellates) over the past three years. Here, the recipes, the methods of preparation and the chemical composition of Aquil are presented in detail. To permit complete definition of chemical speciation of the various components as calculated from thermodynamic equilibria, trace element contamination is controlled and the formation of precipitates and adsorbates is avoided. It is established that Aquil is suitable for physiological experiments with a variety of marine phytoplankters representing all major phyta. Modifications of the basic recipe and design of chemically defined media in general are discussed. (Katz-EIS)
W79-09779

TOXICITY OF SUBTROPICAL MARINE ALGAE USING FISH MORTALITY AND RED BLOOD CELL HEMOLYSIS FOR BIOASSAYS,
Miami Univ., FL. Div. of Biology and Living Resources.
N. M. Targett, and A. Mitsui.
Journal of Phycology, Vol. 15, p 181-185, 1979. 3 fig, 1 tab, 43 ref.

Descriptors: *Bioassay, *Mortality, *Toxins, *Marine algae, *Toxicity, *Algal toxins, *Lethal limit, Laboratory tests, Algae, Aquatic plants, Chlorophyta, Rhodophyta, Phaeophyta, Sea bream, Caulerpa, Anadyomene, Penicillus, Centroceras, Dictyota, Laurencia, Wrangelia, Poisons, Poisonous plants, Erythrocyte hemolysis, Methodology.

Two bioassays (fish mortality and fish erythrocyte hemolysis) were used to survey for the presence of toxic principles in aqueous extracts of 19 species of marine macro-algae found in south Florida coastal waters. Extracts from six species (Chlorophyta -- Anadyomene stellata, Caulerpa prolifer, Penicillus capitatus -- Centroceras clavulatum, Laurencia papillosa, L. poitel) showed lethal toxicity to the spotfin mojarra, Euconistomus argenteus. Extracts from three species (Chlorophyta -- A. stellata: Phaeophyta -- Dictyota dichotoma: Rhodophyta -- Wrangelia penicillata) lysed erythrocytes of sea bream, Archosargus rhomboidalis. (D. Katz-EIS)
W79-09780

A MORPHOMETRIC STUDY OF EFFECTS OF NICKEL, CHROMIUM AND CADMIUM ON THE SECONDARY LAMELLAE OF RAINBOW TROUT GILLS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
G. M. Hughes, S. F. Perry, and V. M. Brown.
Water Research, Vol. 13, p 665-679, 1979, 13 fig, 9 tab, 15 ref.

Descriptors: *Rainbow trout, *Respiration, *Water pollution effects, *Nickel, *Chromium, *Cadmium, *Sublethal effects, Environmental effects, Histology, Pathology, Fish physiology, Salmo, Oxygen, Metals, Industrial wastes, Heavy metals, Trout, Salmonids, Gills, Sublethal effects, Freshwater fish, Gases, Gas exchange.

Rainbow trout were exposed in a constantly flowing hard water for 3.5 days to concentrations of nickel and chromium at about 0.05 and 0.2, respectively, of the 48-h LC50 for this species, and for 234 days to cadmium at about 0.001 of its 48-h LC50. Morphometric measurements were made of structural components of the gill secondary lamellae from fish both immediately following their removal from the test solution and at various intervals (up to 21 days) during which they were kept in 'clean' water. Diffusing capacities were calculated and indicated changes in the ability of fish to transfer oxygen from the water to the blood. Only nickel appeared to have a marked harmful effect, and recovery to normal diffusing capacity occurred within 21 days. Following the chromium and cadmium treatments, statistically significant changes were not detectable but possible trends were indicated. In the case of cadmium, some suggestion of an increase in diffusing capacity at the lowest concentration (0.002 mg/l) was observed. (D. Katz-EIS)
W79-09781

IDENTIFICATION OF SUBSTANCES TRANSFERRED TO FISH OR SHELLFISH FROM PETROLEUM SUSPENSION,
Okayama Univ. (Japan). Dept. of Public Hygiene.
M. Ogata, Y. Miyaka, and Y. Yamasaki.
Water Research, Vol. 13, p 613-618, 1979. 1 tab, 5 fig, 8 ref.

Descriptors: *Path of pollutants, *Pollutant identification, *Sulfur compounds, *Oil pollution, *Bioindicators, *Clams, *Eels, Invertebrates, Organic compounds, Bioassay, Bioaccumulation, Chemical analysis, Monitoring, Shellfish, Sulfur, Analytical techniques, Gas chromatography, Water pollution absorption.

Identification of organic sulfur compounds contained in crude oil as a marker of oil pollution of fish and shellfish was performed. Eels (Anquilla japonica) or short-necked clams (Tapes amygdala philippinarum A.) were maintained in a controlled laboratory environment of water with a suspension of crude oil. Gas chromatography mass spectrometry of eel flesh extract showed the presence of 1-methyl, 2-methyl, dimethyl, trimethylnaphthalenes and dibenzothrophene, and that of soft body of short-necked clams showed dimethyl, trimethylnaphthalene, dibenzothropene, and monomethyl and dimethyldibenzothiophenes. Trace amounts of organic sulfur compounds in the crude oil, eel flesh and soft bodies of short-necked clams could be determined by gas chromatography attached with FPD, therefore these compounds are recommended as a marker of oil pollution in fish and shellfish. (D. Katz-EIS)
W79-09782

ICHTHYOTOXICITY OF A FLAGELLATE UROGLENA VOLVOX,
Tokyo Univ. (Japan). Lab. of Marine Biochemistry.
H. Kamiya, K. Naka, and K. Hashimoto.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 1, p 129, 1979. 1 tab, 2 ref.

Descriptors: *Uroglena, *Flagellates, *Toxins, *Piscicides, *Fatty acids, *Zooplankton, Chemical analysis, Fish behavior, Fish kill, Laboratory tests, Water quality control, Mortality ichthyotoxins, Free fatty acids, Ayu-fish, Commercial fish, Phytoplankton.

The flagellate Uroglena volvox is highly toxic to the commercially important ayu-fish, Plecoglossus altivelis. Extraction and purification of the flagellate produced a final preparation which was found to be lethal at 50 ppm to test fish. The toxin was shown to be composed of fatty acids, comprised mainly of myristic (C14:0), palmitic (C16:0) and docosatetraenoic acid (C22:4). The flagellate free water was also toxic to the ayu-fish suggesting that U. volvox secretes fatty acids to the environment. (D. Katz-EIS)
W79-09783

FLURIDONE, A NEW HERBICIDE FOR AQUATIC PLANT MANAGEMENT,
Lilly Research Lab., Greenfield, IN.
M. C. McCowen, C. L. Young, S. D. West, S. J. Parka, and W. R. Arnold.
Journal of Aquatic Plant Management, Vol. 17, p 27-30, 1979. 12 tab, 5 ref.

Descriptors: *Herbicides, *Fluridone, *Aquatic weed control, *Pre-emergents, *Mode of action, *Pest control, *Primary productivity, Pesticides, Plant growth regulators, Weed control, Water quality, On-site investigations, Toxicity, Chlorophyll, Biochemistry, Sago pondweed, Bioassay, Hydrilla, Myriophyllum, Ceratophyllum, Najas, Lemna, Potamogeton, Aquatic plants.

Fluridone, as a 180 g/liter aqueous suspension (4 lb/gal AS) or 2.5 percent granule at rates from 0.1

to 1.0 ppm a.i. total water treatment, applied over the water surface, directly under the water surface, or as a layered treatment to the bottom of the body of water, provided control of many submersed and emersed aquatic plant species. Fluridone did not have any adverse effect on water quality, water chemistry, or aquatic life present in the treated bodies of water. (D. Katz-EIS)
W79-09784

FLURIDONE - A NEW AQUATIC HERBICIDE,
Lilly Research Lab., Greenfield, IN.
W. R. Arnold.
Journal of Aquatic Plant Management, Vol. 17, p 30-33, 1979. 12 ref.

Descriptors: *Herbicides, *Environmental effects, *Water quality control, *Aquatic weed control, *Pre-emergents, *Plant growth regulators, *Fluridone, *Primary productivity, Aquiculture, Pesticides, Pest control, Water quality, Weed control, Aquatic plants, Toxicity, Bioassay, Dissolved oxygen, On-site investigation, Plankton, Benthos, Environmental effects, Zooplankton, Waterfowl, Fish.

A new experimental herbicide Fluridone (1-methyl-3-phenyl-5-(3- (trifluoromethyl) phenyl) -4-(1H) -pyridinone) is active in aquatic systems at rates as low as 1.12 kg/ha. Effective control can be obtained using either surface or bottom application techniques. Fluridone is a safe, slow-acting, translocated herbicide that provides control of aquatic plants without affecting phytoplankton, zooplankton, benthic organisms or fish. Fluridone does not affect water quality and appears to increase the dissolved oxygen concentration within the water profile. (D. Katz-EIS)
W79-09785

COMPARATIVE ALGICIDE EVALUATIONS USING LABORATORY AND FIELD ALGAE,
Florida International Univ., Miami. Drinking Water Quality Research Center.
G. P. Fitzgerald, and D. F. Jackson.
Journal of Aquatic Plant Management, Vol. 17, p 66-71, 1979. 8 tab, 20 ref.

Descriptors: *Swimming pool algicides, *Algae, *Chlorella, *Algicides, *Aquatic weed control, *Lethal limit, *Laboratory tests, *Toxicity, Phormidium, Aquatic algae, Aquatic plants, Methodology, Algimycin 400, Copper, Pesticides, Bioassay, Analytical techniques, Filamentous algae, Environmental effects.

Swimming pool algicides were evaluated under standard conditions using Chlorella pyrenoidosa and Phormidium inundatum ('Black Algae'). Four-hour treatments were used for testing algicidal properties. Results of algistatic and algicidal tests showed that commercial copper products are not suitable for swimming pool use as algicides, but would kill lake and pond problem algae. Algimycin 400 (an organic product) was adequate for swimming pools. Short term algicide tests (10 minute contact) with pond algae indicated that Algimycin PLL-C (copper chelated with citrate and gluconate) was the most effective copper containing product tested. Some products required as much as 10 times more copper than others. Tests of algicides demonstrated detoxification by their reactions with algae. (D. Katz-EIS)
W79-09786

BIOACCUMULATION AND ELIMINATION OF COPPER IN THE ROCK OYSTER CRASSOSTREA CUCULLATA,
National Inst. of Oceanography, Goa (India).
C. D'Silva, and S. Z. Qasim.
Marine Biology, Vol. 52, No. 4, p 343-346, 1979. 1 fig, 11 ref.

Descriptors: *Copper, *Bioaccumulation, *Absorption, *Path of pollutants, *Oysters, *Animal behavior, Toxins, Shellfish, Invertebrates, Depuration, Metals, Mollusks, Public health, Self-purification, Crassostrea, Bioassay, Laboratory tests.

The kinetics of copper bioaccumulation in the rock oyster Crassostrea cucullata showed that the initial rate of uptake was directly related to metal concentration in the medium. As the accumulation in the tissues increased, the oysters remained closed and the uptake rate fell. At the end of 7 weeks, the average copper concentrations in the tissue were 60.42 microg/g and 63.97 microg/g wet weight in the 0.01 and 0.05 ppm experimental groups, respectively. The net rate of uptake ranged from 1.76 to 1.97 microg/g/week and the rate of copper loss, measured after transferring the oysters into natural sea water, was dependent on the original copper concentration in the soft parts. The concentration of copper in the tissues declined by 37.38 and 36.56% in the 0.01 and 0.05 ppm experimental groups, respectively. Even after a 7 week period of depuration (self-purification) there was some residual copper left in the tissue. This indicates that accumulation occurs in the tissue more rapidly than cleansing can eliminate it. (D. Katz-EIS)
W79-09787

AN INEXPENSIVE SUSPENDED SEDIMENT SAMPLER,
Massachusetts Univ., Amherst.
S. P. Leatherman.
Estuaries, Vol. 2, No. 2, p 135-136, 1979. 1 fig, 5 ref.

Descriptors: *Methodology, *Equipment, *Suspended solids, *Sediments, *Sampling technology, Water quality, Swash/Surf studies, Sediment transport, On-site data collections, Design, Specifications.

The design for an inexpensive apparatus for collecting suspended sediments in the swash/surf zone is presented. This device can be employed whenever nearly simultaneous samples in a vertical water column are required. The design allows for the detection of relatively high frequency concentrations of suspended sediment. No special tools are required for the construction of the sampler which can be built from common commercial materials for about $10. (D. Katz-EIS)
W79-09788

THE ACUTE TOXICITY OF SOME PETROCHEMICALS TO GOLDFISH,
Koninklijke Shell-Laboratorium Amsterdam (Netherlands).
A. L. Bridie, C. J. M. Wolff, and M. Winter.
Water Research, Vol. 13, p 623-626, 1979. 1 tab, 8 ref.

Descriptors: *Toxicity, *Lethal limit, *Petrochemicals, *Organic compounds, *Alcohols, *Organic acids, *Mortality, Bioassay, Carassius auratus, Laboratory tests, Chemicals, Methodology, Amines, Halogenated hydrocarbons, Hydrocarbons, Ketones, Toxins, Water pollution sources, Allyl alcohol.

The acute toxicities to goldfish (Carassius auratus) of 118 industrial chemicals derived from petroleum have been determined. The results of the tests are presented here. The toxicity data for these organic chemicals are listed in tabular form. Allyl alcohol and allyl Bromide were the most toxic. (D. Katz-EIS)
W79-09789

THE ACUTE TOXICITY OF CS TO RAINBOW TROUT,
Water Research Centre, Stevenage (England).
F. S. H. Abram, and P. Wilson.
Water Research, Vol. 13, p 631-635, 1979. 2 tab, 6 fig, 9 ref.

Descriptors: *CS gas, *Toxicity, *Lethal limit, *Bioassay, *Poisons laboratory tests, Mortality, Rainbow trout, Trout, Salmonids, Freshwater fish, Water pollution effects, Water pollution sources, Synergistic effects, Chemical analysis, Methodology.

The irritant compound known as 'CS gas' (orthochlorobenzylidene malonitrile) may find its way into surface waters under certain conditions. This paper describes the acute toxicity to trout of CS and its two principal hydrolysis products, which appear to behave synergistically. CS is lethal to rainbow trout within 1 week at concentrations greater than 0.1 mg/l. This lethal toxicity cannot be explained by simple summation of the toxicities of the two hydrolysis products of CS, which is greater than expected. The lethal toxicity cannot be reproduced by mixing the two hydrolysis products, malonotrile and ortho-chlorobenzaldehyde. (D. Katz-EIS)
W79-09790

THE VALUE AND LIMITATIONS OF VARIOUS APPROACHES TO THE MONITORING OF WATER QUALITY FOR FRESHWATER FISH,
Food and Agriculture Organization of the United Nations, Rome (Italy) EIFAC Working Party on Biological Monitoring.
EIFAC Technical Paper No. 32, Rome, Italy, 1978. 27 p, 5 fig, 2 tab, 36 ref.

Descriptors: *Monitoring, *Methodology, Commercial fisheries, Commercial shellfisheries, Water quality, Freshwater fish, *Fish management, Fish populations, On-site investigations, Chemical analysis, *Biological inventories, Bioassays, Toxicological information, Biological monitoring.

There is a necessity to monitor for the protection of the fresh water fishery resource. The advantages and disadvantages of three types of monitoring systems in measuring the effect of changes in water quality are discussed. The three types are monitoring of water quality for the chemical pollutants that are introduced; monitoring of the aquatic invertebrate community; or monitoring the fish community. The relationship between water quality, the quality of the aquatic environment, the general biological community and desirable fish and shellfish are close. The relevance and reliability of chemical and toxicological information to desirable aquatic populations are open to question. Monitoring the fisheries is desirable but changes in the fish populations are difficult to detect.
W79-09791

PHOSPHORUS IN THE WATER, SEDIMENT, AND VEGETATION OF THE CRNOJEVICA RIVER, MONTENEGRO, YUGOSLAVIA,
Hobart and William Smith Colleges, Geneva, NY. Dept. of Biology.
C. S. Smith, M. S. Adams, M. R. Schmitt, and S. S. Adams.
Verhandlungen International Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1536-1542, 1978. 3 fig, 1 tab, 13 ref.

Descriptors: *Nutrients, Water pollution effects, Water pollution sources, Path of pollutants, *Phosphorus compounds, Water quality, *Sediments, Macrophytic vegetation, Crnojevica River, Yugoslavia, Phosphorus loss, Tissue content, Inorganic phosphorus, Fish establishment, *Fish processing plant.

A study was made of the effects of wastes from a fish processing plant on the water, sediment and vegetation of the Crnojevica River, Yugoslavia. The P content of water, sediment, and macrophytic vegetation was measured at intervals along a 9 km stretch downstream from a source of P input in the Crnojevica River, Montenegro, Yugoslavia. TP and TDP in the water both declined exponentially along the course of the river with fractional loss rates of 0.31/km and 0.27/km, respectively, indicating a very efficient P removal mechanism. The efficiency of this mechanism prevented much of the P load from being transported downstream. Sediment inorganic P also decreased with distance but its concentration could not be directly related to the loss of P from the water column. The concentration of P in the vegetation was always well above that required for growth and was not correlated with any of the other parameters measured. (Katz-EIS)
W79-09792

LIMNOLOGY OF RUTLAND WATER,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.

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D. Harper.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1604-1611, 1978. 6 fig, 9 ref.

Descriptors: *Nutrients, Eutrophy, *Reservoirs, Chlorophyll, *Algae, Chlorophyll distribution, Chloride, Nitrates, Silica, Silicates, Phosphorous compounds, Rutland water, England, Limnology, Reservoir operations, Reservoir storage, *Pumped storage.

Rutland Water is a large pumped storage reservoir in the East of England. The options available for limnological management of Rutland Water will ensure a continuity of supply despite its highly eutrophic state. Algal problems common in other eutrophic reservoirs should not occur in Rutland Water. Nutrients, chlorophyll concentrations and major algal species in Rutland Water were measured. (Katz-EIS)
W79-09793

EFFECTS OF PUMPED STORAGE OPERATIONS ON ROTIFER POPULATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. L. Buikema, Jr., and P. H. Loeffelman.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1597-1603, 1978. 6 fig, 16 ref.

Descriptors: *Pumped storage, *Zooplankton, *Rotifers, Virginia, *Thermal stratification, Depth, Depth distribution, Animal population, Animal numbers, Pumpback operations, Reservoirs, reservoir management, Sampling.

The effects of pumpback in Smith Mountain Lake appeared to be beneficial to rotifer production. Pumpback generally increased the abundance of rotifers, lengthened the vertical distribution of rotifers in the water column and increased the abundance of rotifers at lower depths in the lake. The effect of pumped storage operations in the lake is very complex. Predation was mimicked and normal thermal characteristics of the lake were altered to the apparent benefit of the rotifers. (Katz-EIS)
W79-09794

ATTACHED ALGAE AT THERMAL GENERATING STATIONS -- THE EFFECT OF TEMPERATURE ON CLADOPHORA,
Ontario Ministry of the Environment, Toronto. Water Resources Branch.
L. F. Moore.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1727-1733, 1978. 3 fig, 1 tab, 12 ref.

Descriptors: Algae, *Benthic algae, *Thermal power, Thermal pollution, Water pollution effects, Source of pollution, *Cladophora, Nanticoke generating station, Toronto, Canada, On-site-investigation, Photosynthesis, Primary productivity, Water temperature, Coal fired generating station, Lake Erie.

The relationship between temperature and the species composition of the attached algal community was investigated at a coal-fired generating station on the north shore of Lake Erie. The photosynthetic rate of the dominant member of this community, Cladophora glomerata, was measured at three temperatures on seven dates. The temperature required to initiate Cladophora growth in the spring was found to be approximately 11C. This temperature was reached in February in the immediate discharge. April in the discharge downstream from the addition of tempering water and in May in the control areas. Ulothrix became dominant in the late fall when temperatures fell below approximately 8 degrees C. The photosynthetic rate of Cladophora increased with increasing temperature to 26 degrees C but 33 degrees C was inhibitory. (Katz-EIS)
W79-09795

RANGE OF CHANGES IN FISHPOND ENVIRONMENT INFLUENCED BY INTENSIVE CARP FARMING,
Polish Academy of Sciences, Golysz. Fish Culture Station.
J. Szumiec.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 4, p 2137-2141, 1978. 6 fig, 4 ref.

Descriptors: *Aquiculture, *Freshwater fish, Carp, *Water quality, *Nutrients, Phytoplankton, Supersaturation, Oxygen, On-site-investigation, Commercial fisheries, Nitrogen compounds, Ammonia, Poland, fish ponds.

Intensive carp culture results in the eutrophication of the farm ponds. Proper oxygenation of the pond water is critical. All biochemical and biological processes are stimulated including the ability for self purification. Oxygen is produced by the large phytoplankton populations and should be sufficient to cover the night oxygen demand of the ecosystem. Ammonia nitrogen seldom rose above 0.1 mg/1 of NH3 even in the intensively cultured ponds. Dissolved oxygen values especially in the intensively cultured ponds were over supersaturation. (Katz-EIS)
W79-09796

MACROINVERTEBRATE ASSOCIATIONS WITH AQUATIC MACROPHYTES AND ARTIFICIAL SUBSTRATES,
Toronto Univ. (Ontario). Dept. of Zoology.
N. Gerrish, and J. M. Bristow.
Journal of Great Lakes Research, Vol. 5, No. 1, p 69-72, 1979. 1 fig, 2 tab, 11 ref.

Descriptors: *Invertebrates, *Aquatic plants, *Habitats, *Aquatic environment, *Artificial substrates, *Biological communities, Aquatic algae, Primary productivity, Productivity, Diptera, Reproduction, Myriophyllum, Potamogeton, Vallisneria, Populations, Niches, Lake Opinicon, Ontario.

Macroinvertebrate populations associated with Myriophyllum exalbescens, Potamogeton richardsonii, and Vallisneria americana were compared with those on plastic 'plants' similar in morphology to P. richardsonii. The density of organisms varied according to macrophyte species (Myriophyllum-much greater than Potamogeton-greater than Vallisneria). The plastic imitations did not differ significantly from Potamogeton in the total numbers of macrophytes they harboured at two different sampling periods during the growing season. A similar macroinvertebrate species composition occurred in association with the three plant species and with the artificial substrates. (D. Katz-EIS)
W79-09798

CHRONIC EXPOSURE OF TROUT TO WATERS WITH NATURALLY HIGH SELENIUM LEVELS: EFFECTS ON TRANSFER RNA METHYLATION,
Wyoming Univ., Laramie.
I. I. Kaiser, P. A. Young, and J. D. Johnson.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 689-694, 1979. 2 fig, 2 tab, 22 ref.

Descriptors: *Salmo gairdneri, *Salmo trutta, *Rainbow trout, *Brown trout, *Biochemistry, *Selenium, *RNA methylation, *Selenium, *Nutrients, Biological methylation, Nucleoside analysis, Trace elements, Salmonids, Trout, Tissue analysis, Bioaccumulation, Transfer RNA.

Liver tissues from rainbow (Salmo gairdneri) and brown (S. trutta) trout chronically exposed to waters with naturally high selenium levels accumulate significant amounts of the element, with values in the 50-70 microgram/gram range (fresh tissue) not unusual. This accumulation appears to increase with time since older fish from the same waters invariably contain higher liver selenium levels. Studies in other systems suggested that there might be gross alterations in cellular macromolecular methylations in fish chronically exposed to elevated selenium levels. Mature tRNAs isolated from trout livers having both low and high selenium levels, however, showed no difference in their methyl-accepting abilities in a homologous in vitro methylating system. In addition, direct nucleoside analyses on these different tRNA samples showed similar levels of base methylation, with no evidence for methylation abberations. The nucleoside analyses on the tRNAs were similar in keeping with values reported for other eukaryotic systems. (D. Katz-EIS)
W79-09799

BIOACCUMULATION OF MERCURY IN SARCOSAPROPHAGOUS INSECTS,
Helsinki Univ. (Finalnd). Dept. of Environmental Science.
P. Nuorteva, E. Hasanen, and S.-L. Nuorteva.
Norwegian Journal of Entomology, Vol. 25, p 79-80, 1978. 1 fig.

Descriptors: *Mercury, *Metals, Bioassay, Water pollution effects, Path of pollutants, Insects, Flies, Tissue concentrations, Laboratory tests, Bioaccumulation, Blowflies, Mercury accumulation, Sarcosaprophagous insects.

In an experimental rearing of blowflies on a pike with 2.7 ppm Hg in the flesh, an accidental group of sphaerocerid flies, Limosina empirica developed. The imagines of L. empirica had 23.3 - 40.3 ppm mercury in their bodies, while the imagines of the four blowfly species in the same experiment had only 13.3 - 14.6 ppm Hg. (Katz-EIS)
W79-09801

TEMPERATURE PREFERENCE OF THE WHITE PERCH, MORONE AMERICANA, COLLECTED IN THE WICOMICO RIVER, MARYLAND,
Frostburg State Coll., MD. Center for Environmental and Estuarine Studies.
L. W. Hall, Jr., C. H Hocutt, and J. R. Stauffer, Jr.
Estuaries, Vol. 2, No. 2, p 129-132, 1979. 1 tab, 1 fig, 15 ref.

Descriptors: *Water temperature, *Fish behavior, *White perch, *Temperature preference, Aquatic environment, Analytical techniques, Acclimation, Perches, Morone, Freshwater fish, Fish, Temperature, Laboratory tests, Aquatic habitats, Behavior, Maryland, Wicomico River.

Temperature preference tests were conducted on fresh water white perch (Morone americana), collected from the Wicomico River, Maryland. Collection temperature was 27 C and acclimation temperatures used in temperature preference tests were 6, 12, 18, 24, 30, and 33 C. The following methods were used to determine the final temperature preference: linear regression, quadratic equation, and 'eyeball' plots. Recorded final temperature preference values were 28.9, 29.3 and 30.6 C using each method, respectively. (D. Katz-EIS)
W79-09802

ACUTE AMMONIA TOXICITY AND AMMONIA EXCRETION IN RAINBOW TROUT (SALMO GAIRDNERI),
British Columbia Univ., Vancouver. Dept. of Zoology.
B A. Hillaby, and D. J. Randall.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 621-629, 1979. 5 tab, 7 fig, 37 ref.

Descriptors: *Toxicity, *Ammonia, *Nitrogen compounds, *Rainbow trout, *Salmo gairdneri, *Fish physiology, *Nitrogen compounds, *Mode of action, Trout, Salmonids, Blood chemistry, Ammonia excretion, Laboratory tests, Blood pH, Bicarbonates, Biochemistry, Metabolism, Hydrogen ion concentration.

Acute ammonia toxicity in rainbow trout was studied by intraarterial injection of NH_4Cl and NH_4HCO_3. Hydrogen ion and total ammonia concentrations were measured in blood sampled from the dorsal aorta both before and after injection. Although injection of NH_4HCO_3 increased arterial

blood pH, and injection of NH4Cl decreased arterial blood pH, the same dose of each was required to kill fish. While the un-ionized form of ammonia in water has been shown to be toxic, in the blood either the ionized form or the total ammonia load is toxic to fish. Ammonia levels were measured in pre- and postbranchial blood. Mean values were not significantly different, but paired values indicated a fall in blood ammonia due to excretion across the gills. There appears to be a more rapid excretion of ammonia following NH4HC03 infusions, which result in higher un-ionized ammonia levels in blood compared with those following NH4Cl infusions. These results are consistent with the hypothesis that ammonia is excreted in the un-ionized form. (D. Katz-EIS)
W79-09805

PHYTOPLANKTON RECOVERY AFTER POWER PLANT ENTRAINMENT,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman, and H. L. Quinby.
Journal of the Water Pollution Control Federation, Vol. 51, No. 7, p 1811-1823, 1979. 4 fig, 3 tab, 27 ref.

Descriptors: *Phytoplankton, *Electric power plants, Marine phytoplankton, *Chlorination, *Water temperature, Mortality, Toxicity, Plant population, Entrainment, Recovery, Steam generating plant, Cape Cod Plant, Montauk Plant, Narragansett Bay, Massachusetts, Bioassay, Laboratory tests, Cape Cod Canal, Chlorine concentration, Phytoplankton population, Biomass, Enzymes, ATP, Chlorophyll.

Natural populations of marine phytoplankton from the intake and discharge stations of two coastal power plants in southeastern Massachusetts all demonstrated the same degree of recovery when grown in continuous cultures with a defined artificial seawater medium. Neither populations exposed to elevated temperatures nor those subject to chlorination and heat treatment showed any adverse permanent effects. The flora of phytoplankton species dominating in all samples for a particular experiment were consistently similar, indicating that alterations in the composition of phytoplankton species in receiving waters may be hardly measurable. It is concluded that entrainment effects on both phyto- and permanent zooplankton populations in receiving waters, because of their relatively rapid generation periods, are probably minor compared with the potentially major effects on larval plankton that spawn intermittently. (Katz-EIS)
W79-09808

INFLUENCE OF FRESHWATER INTRUSION ON MICROBIAL BIOMASS IN SALT-MARSH CREEKS,
South Carolina Univ., Columbia. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-09809

EFFECT OF FISH AGE ON PREDICTED AND OBSERVED CHRONIC TOXICITY OF LEAD TO RAINBOW TROUT IN LAKE ONTARIO WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
P. Hodson, B. R. Blunt, D. Jensen, and S. Morgan.
Journal of Great Lakes Research, Vol. 5, No. 1, p 84-89, 1979. 3 fig, 3 tab, 11 ref.

Descriptors: *Salmo gairdneri, *Rainbow trout, *Bioassay, *Lead, *Toxicity, *Fish pathology, *Sublethal effects, *Growth stages, Fish eggs, Immature growth stage, Laboratory tests, Heavy metals, Water pollution effects, Lake Ontario, Inhibitors, Trout, Pathology, Fish diseases, Enzymes, Biochemistry, Metabolism, Salmonids, Hardness(Water), Water properties, Uptake, Bioaccumulation.

Exposure of rainbow trout (Salmo gairdneri) starting at the egg stage to water-borne lead in Lake Ontario water (hardness of 135 mg CaCO3/L) resulted in black tails (early symptoms of spinal deformities) at lead concentrations as low as 22 microg/l. No black tails were observed at 11 microg/l. Previous publications demonstrated that the lowest lead concentration causing black tails in trout exposed from the fingerling stage in Lake Ontario water was 120 microg/l, suggesting that fish exposed from the egg stage are 5 times as sensitive as those exposed from the fingerling stage. Compared to previously published data on fish exposed from the egg stage, blood lead of fish exposed from the egg stage was greater for a similar lead exposure. However, the relationship between blood lead and enzyme inhibition (erythrocyte delta-amino levulinic acid dehydratase) was unchanged. Therefore the increased sensitivity of trout exposed from the egg stage was probably due to enhanced lead accumulation rather than to an enhanced response to the lead taken up. The incidence of black tails at this hardness corresponded well to a prediction based on published lead toxicity at extremes of water hardness. (D. Katz-EIS)
W79-09810

EFFECTS OF ACIDIC PRECIPITATION ON PRECAMBRIAN FRESHWATERS IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Rexdale. Water Resources Branch.
W. A. Scheider, D. S. Jeffries, and P. J. Dillon.
Journal of Great Lakes Research, Vol. 5, No. 1, p 45-51, 1979. 5 fig, 4 tab, 18 ref.

Descriptors: *Hydrogen ion concentration, *Precipitation(Atmospheric), *Freshwater, *Environmental effects, *Water properties, *Buffering capacity, *Geochemistry, Acidity, Acidic water, Reproduction, Freshwater fish, Chemical properties, Water pollution sources, Precambrian lakes, Soil chemistry, Manganese, Aluminum, Southern Ontario.

The pH of precipitation falling on the Precambrian Shield of south-central Ontario averages 4.0-4.2 as low or lower than that of precipitation in areas of the world with recognized problems of acidification of freshwaters. The area is underlain by non-calcareous bedrock of low solubility with a thin glacial overburden, and consequently many lakes have low buffering capacities. Some lakes and streams have had their pH's reduced by acidic precipitation, especially during spring runoff and after storm events. The pH of some lakes is 5.0-5.5, a level at which the reproductive success of certain fish species is impaired. Walleye of the same length show Hg levels in low alkalinity (less than 300 micro eq/1) waters compared to higher alkalinity waters. (D. Katz-EIS)
W79-09812

ON THE HEAVY METALS AND CHLORINATED HYDROCARBONS IN THE GULF OF BOTHNIA IN FINLAND,
National Water Board of Finland, Helsinki.
V. Miettinen, and M. Verta.
Finnish Marine Research, No. 244, p 219-226, 1978. 1 fig, 6 tab, 18 ref.

Descriptors: *Path of pollutants, *Heavy metals, *Gulf of Bothnia(Finland), *Reviews, *Chlorinated hydrocarbon pesticides, *Monitoring, Water pollution effects, Bottom sediments, Benthos, Zooplankton, Fish, Mercury, Zinc, Cadmium, Copper, Arsenic, Baseline studies, DDT, Dieldrin, Polychlorinated biphenyls.

This review describes studies carried out on heavy metals and chlorinated hydrocarbons in the sediments and aquatic biota in the eastern Gulf of Bothnia at the beginning of the 1970's. The future monitoring of toxic substances and measures to intensify the use of the results are also discussed. In the eastern Gulf of Bothnia the areas polluted by heavy metals, are off Eurajoki, Pori, Kokkola and Oulu. Concentrations of chlorinated hydrocarbons in the Bothnian Bay are lower than in other areas. The differences between the levels of toxic substances in various coastal areas of Finland show that bottom sediments and aquatic organisms can be used to establish and monitor the areas polluted by toxic substances. The systematic monitoring of concentrations in fish has been started. (D. Katz-EIS)
W79-09814

THE LITTLENECK CLAM, PROTOTHACA STAMINEA, AS A TOOL FOR POTENTIAL OIL POLLUTION ASSESSMENT: PART I -- DENSITY OF STOCK,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
J. R. Vanderhorst, and P. Wilkinson.
Marine Environmental Research, Vol. 2, No. 3, p 223-237, 1979. 1 tab, 7 fig, 19 ref.

Descriptors: *Clams, *Sampling, *Aquiculture, *Stock density, *Aquatic populations, Statistical models, Analytical techniques, Water pollution effects, Shellfish, Intertidal species, On-site investigations, Oil wastes, Costs, Protothaca, Mollusks, Invertebrates, Plot density, Commercial shellfish.

Littleneck clams, Protothaca staminea, were sampled on two plots in the north Puget Sound region to evaluate the effects of sampling strategy on costs for measuring plot density in an hypothesis-testing framework. The general approach involved quadrat sampling on permanently marked plots. Results indicated that detection of differences in density as small as 10% with 80% probability would: (1) exceed in cost the economic value of 10% of the stock and (2) decimate more than 10% of the stock unless provisions were made to allow survival of sampled clams. Restriction of sampling to the marketable cohort, restriction of sampling to parts of plots covered by vegetation, increasing the probability for a Type I error and use of a smaller quadrat size all served to substantially reduce sampling costs. The projections of sampling requirements were made using estimates of variance obtained from sampling in differing manners and at different seasons. The estimates so obtained did not give good uniformity. This has an important ramification for pollutant studies because a common variance for control and 'polluted' means is an assumption central to the use of probability models. (D. Katz-EIS)
W79-09815

EFFECTS OF ZINC ON JUVENILE ATLANTIC SALMON SALMO SALAR: ACUTE TOXICITY, FOOD INTAKE, GROWTH AND BIOACCUMULATION,
Fisheries and Marine Service, Halifax (Nova Scotia).
G. J. Farmer, D. Ashfield, and H. S. Samant.
Environmental Pollution, Vol. 19, p 103-117, 1979. 4 fig, 3 tab, 30 ref.

Descriptors: *Zinc, *Sublethal effects, *Feeding rates, *Fish behavior, *Atlantic salmon, *Environmental effects, Bioaccumulation, Toxicity, Water quality, Laboratory tests, Bioassay, Behavior, Growth rates, Salmo salar, Water pollution sources, Water pollution effects, Salmon, Salmonids, Mathematical models, Adaptation.

The effects of long-term zinc exposure on juvenile salmon were assessed by measuring changes in their voluntary food intake, growth and rate of zinc accumulation. The food intake of salmon surviving concentrations as great as the 21-day LC50 was initially reduced but returned to amounts observed for control fish within 10 to 20 days. After 45 days' exposure, the food intake of these individuals was greater than that of the controls. Growth rates of salmon exposed to zinc (maximum concentration estimated to cause mortality less than or equal to 50% during acute bioassay) and offered rations of 2.0 or 3.5% dry body weight per day were not reduced during a three-month period. However, caloric content of salmon at the higher concentrations showed a small decrease during the experimental period. Zinc concentration of salmon feeding to satiation once daily and exposed to zinc increased during the first two months of exposure before reaching a maximum, while zinc concentration of salmon offered sub-excess rations (2.0 and 3.5% per day) increased linearly during a three-month period. (D. Katz-EIS)
W79-09816

SEASONAL VARIATION OF ZINC IN THE BARNACLE, BALANUS BALANOIDES (L.)

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Group 5A—Identification Of Pollutants

MAINTAINED ON A RAFT IN THE MENAI STRAIT,
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Biology Unit.
G. Walker, and P. Foster.
Marine Environmental Research, Vol. 2, No. 3, p 209-220, 1979. 6 fig, 3 tab, 33 ref.

Descriptors: *Bioindicators, *Monitoring, *Barnacles, *Zinc, Path of pollutants, *Gonads, Seasonal, On-site investigations, Artificial substrates, Trace elements, Reproduction, Absorption, Bioaccumulation, Immature growth stage, Crustaceans, Invertebrates, Balanus, Tissue analysis, Metals, Heavy metals, Copper.

A population of the intertidal barnacle, Balanus balanoides, maintained on a raft in the Menai Strait was sampled regularly over a two-year period and pooled fractions analysed for zinc and other trace metals. The seasonal variation of zinc in three fractions (body, other soft tissues and shell) has been followed and related to physiological condition. The body accumulates zinc almost continuously while this trace metal accumulates in the ovary only as it develops and is lost in the gametes when these are laid. The newly formed egg-masses therefore may be the more useful sample for indicating zinc pollution. (D. Katz-EIS)
W79-09817

BIOACCUMULATING SUBSTANCES--MAINLY DDT AND PCB--IN BIOTA IN THE GULF OF BOTHNIA,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
M. Olsson.
Finnish Marine Research, No. 224, p 227-237, 1978. 9 fig, 15 ref.

Descriptors: *Bioaccumulation, *DDT, *Polychlorinated biphenyls, *Path of pollutants, *Gulf of Bothnia(Baltic Sea), *Bird eggs, *Water pollution effects, Littoral, Mercury, Pikes, Monitoring, Seasonal, Water birds, Mammals, Herring, Chlorinated hydrocarbon pesticides, Baseline studies, Salmon, Reproduction, Pesticides.

Investigations conducted in Sweden concerning the levels of DDT and PCB substances and mercury in biota in the Gulf of Bothnia and the Baltic proper are summarized. Baseline studies on littoral and pelagic fish species are reported. No important differences are noted in levels of DDT and PCB between littoral fish species from the Gulf of Bothnia and the Baltic proper. Herring, however, shows significantly higher levels of DDT in the Baltic proper. Some explanations for the difference between pelagic and littoral fish are discussed. The results of a study of a cross section of the coast of Sweden are summarized. Pike was collected and analyzed for DDT, PCB and mercury. Monitoring studies on guillemot indicate that mercury levels in the Baltic Sea are more or less normal. DDT levels, but not PCB levels, seem to be decreasing. It is important in the planning of a monitoring programme to consider the seasonal variation of PCB recently found in roach. A three-fold increase in PCB levels was found in roach in spring. Some effect studies are summarized. Firstly, DDT substances have reduced eggshell thickness in predatory birds in the Baltic. Secondly, PCB seems to cause a decrease in the reproductive rate in salmon. Finally, PCB affects mammalian reproduction. Field studies on seals, and laboratory investigations on mink show that PCB levels comparable to the levels found in Baltic Sea fish reduce reproductive capacity. Today only about 25% of the Baltic seal population can reproduce. (D. Katz-EIS)
W79-09818

RIVER POLLUTION FROM A LARGE TROUT FARM IN NORWAY,
Fiskeridirektoratets Kjemisk-Tekniske Forskningsinstitutt, Bergen (Norway).
A. Bergheim, and A. R. Selmer-Olsen.
Aquaculture, Vol. 14, p 267-270, 1978. 1 tab, 6 ref.

Descriptors: *Aquiculture, *Water pollution sources, *Water pollution effects, *Fish hatcheries, Nutrients, Fish establishment, Fish farming, Fish management, Trout farm, Norway, River Figgjo, Nitrogen compounds, Phosphorous, Phosphorous compounds, Ammonia, Biochemical oxygen demand.

The pollution loading from 0xna Bruk, a trout farm with an annual fish production of 200-250 tons, and the influence on the water quality of River Figgjo, a medium-sized watercourse, was studied. The feed used was dry pellets. The loadings were estimated to be 0.3 - 0.8 g N/kg fish. 24 h; 0.05 gP/kg fish. 24 h; and 1.6 - 4.6 gO/kg fish. 24 h as BOD7. As a result of the fish farming activities, moderate chemical alterations were registered in the river downstream of the farm at low river flow: decreased oxygen concentration and increased concentrations of total-N (+ 0.2 mg N/1), NH3 + NH4(+)(+0.1 mg N/1), total-P (+0.03 mg P/1) and ortho-P (+0.02 mg P/1). Compared with the receiving water, BOD7 increased maximally 1 mg O/1 downstream of the farm. The salmonid stocks in the river were not affected by the effluents from the trout farm. (Katz-EIS)
W79-09821

EFFECT OF SOLVENTS ON IN VITRO PESTICIDES INHIBITION OF ATPASE IN CERTAIN TISSUES OF LABEO ROHITA,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
R. C. Dalela, S. K. Bansal, A. K. Gupta, and S. R. Verma.
Water, Air and Soil Pollution, Vol. 11, p 201-205, 1979.

Descriptors: *Enzymes, *ATPase, *Bioassay, *Biochemistry, *Chlordane, *Toxicity, *Inhibitors, *Solvents, *Organic compounds, Fish physiology, Freshwater fish, Chlorinated hydrocarbon pesticides, Pesticides, Labeo, Laboratory tests, Organophosphorous pesticides, Metasystox.

This paper deals with the effect of solvents on the pesticide inhibition of ATPase in the gills and brains of a freshwater teleost, Labeo rohita, after in vitro treatment with chlordane (an organochlorine pesticide) and Metasystox (Trade name) (an organophosphate) pesticide after dissolving in different organic solvents viz, benzene, cyclohexane, cyclopentane, dimethylacetamide (DMA), dimethylformamide (DMF), dimethylsulfoxide (DMS), and acetone/ethanol (1:1) mixture. The inhibitory effect of chlordane was greatly reduced by cyclohexane, cyclopentane and benzene, to a less extent by DMA, DMF, and DMS and to a lesser extent by acetone/ethanol (1:1) mixture. ATPase inhibition by Metasystox (Trade name) showed less effect on the inhibition of ATPase activities. Effect on the inhibition of Na(+), K(+) ATPase was observed to be greater than on Mg(++) ATPase in both tissues, but the activity of both the ATPase in gill homogenate was decreased compared to brain homogenate. Choice of solvents can have profound effects on the response of ATPase to chlorinated hydrocarbon pesticides. (D. Katz-EIS)
W79-09822

EFFECTS OF TEMPERATURE AND CURRENT DISCHARGE ON THE CONCENTRATION AND PHOTOSYNTHETIC ACTIVITY OF THE PHYTOPLANKTON IN THE UPPER MISSISSIPPI RIVER,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
A. L. Baker, and K. K. Baker.
Freshwater Biology, Vol. 9, p 191-198, 1979. 5 fig, 22 ref.

Descriptors: *Water temperature, *Photosynthesis, *Phytoplankton, Chlorophyll, Diatoms, Dominant organisms, Cyanophyta, Currents(Water), Productivity, Seasonal, Respiration, Regression analysis, Mississippi River.

Temperature and current discharge regulated phytoplanktonic concentration, chlorophyll-a concentration, the light-saturated rate of photosyntheses, and photosynthetic capacity in the Mississippi River at Prairie Island, Minnesota. The chlorophyll-a maximum was 48 mg cubic meter in 1975, a wet year with a high current discharge, and 190 mg cubic meter in 1976, a relatively dry year. The highest values of photosynthetic rate were 0.37 (mgO2/1/h) in 1975 and 1.60 in 1976. Photosynthetic capacity varied from 30 to 21 (gO2 per g chlorophyll-a/h) both years, and its value was highly correlated with temperature. The temperature optimum shifted from 16 degrees C for photosynthetic capacity in the spring, to greater than 28 degrees C in the summer. Multiple regression analysis indicated a second-order relationship of photosynthetic capacity in the spring to temperature. Other independent variables explained only negligible variation of photosynthetic capacity. (Deal-EIS)
W79-09823

A SURVEY OF HEAVY METALS IN THE SURF CLAM, SPISULA SOLIDISSIMA, AND THE OCEAN QUAHOG, ARCTICA ISLANDICA, OF THE MID-ATLANTIC COAST OF THE UNITED STATES,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
D. R. Wenzloff, R. A. Greig, A. S. Merrill, and J. W. Ropes.
Fishery Bulletin, Vol. 77, No. 1, p 280-285, 1979. 2 tab, 16 ref.

Descriptors: *Commercial shellfish, *Clams, *Heavy metals, *Path of pollutants, *Public health, *Arsenic, *Mercury, Bioaccumulation, *Cadmium, *Chromium, *Copper, *Lead, *Nickel, *Silver, *Zinc, Invertebrates, Metals, Tissue analysis, Quahog, Arctica, Surf clam, Spisula, Mollusks, Methodology.

Quahog and surf clam were collected from 151 stations along the Atlantic coast. The concentrations of nine heavy metals were analysed in both varieties. Results showed that greater average concentrations of silver, arsenic, cadmium, copper and zinc (122, 44.5, 230, 56.0 and 10.9% greater, respectively) were found in ocean quahogs than in surf clams for the entire survey. Concentrations for silver decreased southward in both varieties; arsenic and copper decreased southward in ocean quahogs while zinc concentrations decreased southward in surf clams. Mean arsenic concentrations for all stations were 2.1 ppm in surf clams and 3.0 ppm in ocean quahogs. Concentrations of mercury were found to be well below the action limit set by the FDA. (D. Katz-EIS)
W79-09824

FAUNAL CHANGES IN THE SEVERN ESTUARY OVER SEVERAL DECADES,
University Coll., Cardiff (Wales). Dept. of Zoology.
C. Mettam.
Marine Pollution Bulletin, Vol. 10, p 133-136, 1979. 2 fig, 31 ref.

Descriptors: *Aquatic fauna, *Severn Estuary(Wales), *Estuaries, *Water pollution effects, *Benthic fauna, Aquatic populations, Biological communities, Spatial distribution, Distribution patterns, Industrial wastes, Environmental effects, Crustaceans, Copepods, Worms, Invertebrates, Baseline studies.

Faunistic records for the Severn Estuary do not indicate a reduction in the overall number of species over the last 30 years. Some species have not been recorded recently and changes in abundance and distribution of others have occurred, but none of these changes can confidently be associated with any long-term change in the environment. (D. Katz-EIS)
W79-09825

5B. Sources Of Pollution

EFFECTS OF SURFACE MINING ON HYDROLOGY, EROSION, AND SEDIMENTATION IN EASTERN KENTUCKY,
Northeastern Forest Experiment Station, Berea, KY.
For primary bibliographic entry see Field 4C.
W79-09623

HYDROLOGIC ASPECTS OF SURFACE MINING IN THE EAST,
Northeastern Forest Experiment Station, Berea, KY.
For primary bibliographic entry see Field 4C.
W79-09639

CAUSES OF OYSTER LARVAE MORTALITY IN SOUTH PUGET SOUND,
Washington State Dept. of Fisheries, Olympia.
R. D. Cardwell, S. Olsen, M. I. Carr, and E. W. Sanborn.
NOAA Technical Memorandum ERL MESA-39, April 1979. 79 p, 2 fig, 9 tab, 40 ref.

Descriptors: *Water pollution effects, *Toxicity, Oysters, Dinoflagellates, Mortality, Sewage disposal, Red tide, Washington, Oyster larvae, Crassostrea gigas, Puget Sound(WA), Ceratium fusus, Gymodinium splendens, Marine Ecosystems Analysis Program(MESA).

Water samples were collected from the southern Puget Sound (SPS) basin in September 1977 and characterized for acute toxicity to Pacific oyster larvae (Crassostrea gigas), chemical composition, and biological composition. Certain receiving waters containing the dinoflagellates Ceratium fusus and Gymnodinium splendens were also tested specially to determine if they were toxic to oyster larvae, as was a laboratory culture of C. fusus. Toxicity tests of two sewage treatment plant effluents, ammonium chloride, and salinity were also conducted. The causes of oyster larvae mortality seemed clear from the laboratory and special receiving water bioassays of the dinoflagellates. Several multi-parameter statistical tests attempted to ferret and rank 16 biologic and chemical parameters in terms of their association with receiving water toxicity. Sewage plant effluents had such low toxicity that they could impart only localized toxicity in situ. The recurring aestival receiving water toxicity problem in SPS is believed to affect, at a minimum, other species of bivalve molluscs. Evidence is presented suggesting the susceptibility of adult Pacific oyster, Olympia oyster (Ostrea lurida), and Manila littleneck clam (Venerupis japonica). (NOAA)
W79-09660

ASBESTOS IN COOLING-TOWER WATERS: FINAL REPORT,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
B. G. Lewis.
Report No. NUREG/CR-0770, ANL/ES-71, March 1979. Prepared for the U.S. Nuclear Regulatory Commission. 101 p, 23 fig, 16 tab, 108 ref, 4 append.

Descriptors: *Cooling towers, *Industrial water, *Asbestos, Public health, Cooling water, Recirculated water, Environmental effects, Human diseases, Water pollution effects, Discharge(Water), Freezing, Thawing, Acidic water, Water pollution, Hydroelectric plants, Cements.

The release of asbestos fibers from cooling towers into ambient air or into surface water was assessed. Cooling towers are water-recycling devices used to reduce the quantity of waste heat discharged to surface waters by dissipating up to 95% of the heat directly to the atmosphere. Cooling towers are used for air-conditioning large buildings, cooling in various industries, and increasingly at steam-electric power plants. The asbestos release assessment included a literature review of the human-health-effects of asbestos, collection of information from cooling-tower vendors and users, collection of water, sediment, and air samples at operating cooling towers and analysis for asbestos-fiber content using electron microscope techniques, and estimation of the quantities of fibers that could be released to the ambient air due to drift. At 10 of the 18 towers sampled, chrysotile-asbestos fibers were detected in cooling tower basin and blowdown waters. The major source of these fibers in nonurban areas appears to be the components of the towers rather than the air drawn through the towers or the water taken into the tower to replace evaporation and other losses. Possible release mechanisms are freeze-thaw cycles and dissolution of the cement due to the acidic components of the water. The literature review did not support a causal relationship between the presence of asbestos in food, beverages, or drinking water and the occurrence of human cancers. It is not presently suggested that the use of asbestos in cooling towers be discontinued. However, monitoring should be performed and the data collected used to determine future actions. (Seigler-IPA)
W79-09668

AN INDUSTRIAL RESIDUE MANAGEMENT SYSTEM FOR ALLEGHENY COUNTY, PENNSYLVANIA- PART 1,
Allegheny County Dept. of Works, PA.
D. Berman, E. J. Martin, and D. Joseph.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 254-264, 1977. 5 fig, 5 tab.

Descriptors: *Industrial wastes, *Waste disposal, *Water pollution sources, Industrial plants, Surveys, Heavy metals, Costs, Hazards.

Classification and quantification efforts are discussed and possible collection and transport alternatives are summarized, as part of a study of the generation rates and treatment and disposal alternatives of industrial residues in the Pittsburgh area. The determination of significant sources of residues and establishment of data gathering methodology. Residues were classified into six major types divided into 45 subcategories. Residue amounts were determined by a telephone survey and were entered into a data base. Of the 15,000 metric tons of residue currently generated, 15.5% due to heavy metal or other contents, can be classified as hazardous. Current reclamation, treatment, and disposal practices are summarized. Disposal costs and transport and collection practices and alternatives are discussed. (See also W79-09678) (Small-FRC)
W79-09711

EPA'S COMBINED WASTES PROGRAM RESIDUAL MANAGEMENT STUDIES,
Robert S. Kerr Environmental Research Lab., Ada, OK.
T. E. Short.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 294-299, 1977. 12 tab.

Descriptors: *Metals, *Organic matter, *Municipal wastes, *Pre-treatment(Water), *Regulation, Industrial wastes, Domestic wastes, Surveys.

The quantities of metals and organic matter contributed to the buffalo sewer system by industrial and domestic sources were determined, and the impact of pretreatment regulations on the community was evaluated. A survey determined that an estimated 700,000 persons contribute domestic waste to the system and 605 industries contributed wastes including: agriculture (2), construction (4), manufacturing (417), transportation and utilities (14), wholesale and retail trade (66), and services (102). Wastes were sampled and analyzed. Pretreatment requirements are discussed. A study of the economic feasibility of a regional industrial water treatment facility in the Pittsburgh, PA area is described and discussed. (See also W79-09678) (Small-FRC)
W79-09716

EVALUATION OF THREE OYSTER SHELLSTOCK WASHERS INCLUDING EFFLUENT WATER QUALITY,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
Sin Chau Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 927, Price codes: A08 in paper copy, A01 in microfiche. MS Thesis, 1979. 161 p, 27 fig, 21 tab, 33 ref, append. OWRT A-033-MD(1). 14-34-0001-6021.

Descriptors: *Oysters, *Industrial effluents, Shellfish wastes.

An existing rotary brush and a spray washer were modified and a tumbler washer designed and constructed to explore a better method for washing oyster shellstock. The brush washer utilized horizontal axis rotary brushes in combination with pressurized water spray for cleaning oyster shellstock. The tumbler washer utilized abrasive and tumbling action created by an inclined rotating cylinder in combination with water spray to achieve cleaning. The tumbler washer proved to be unsuitable for washing oyster shellstock, because it severely damaged the oyster meats and shells. The cleaning effectiveness of the spray and brush washers were not significantly different at the 5% level. Separate regression equations were developed relating brush and spray washer operating parameters to the amount of foreign materials removed from the oysters. Compared with a similar washer (Wheaton, 1973), the brush washer was more effective and easier to operate, but further improvement regarding such factors as optimal brush diameter and water recycling is desirable. The brush and spray washers were operated at settings approximating those giving the best cleaning, and effluent BOD5, COD, chloride, chlorine, nitrogen, pH, phosphate, solid concentrations, total coliform count and plate count were monitored. The effluent quality produced by the two washers was not significantly different at the 5% level except for pH. Effluent quality complied with all existing EPA and/or Maryland discharge limits, with the exception of high total coliform and/or plate counts. Thus, effluent disinfection will be needed to meet present limits.
W79-09720

GEOHYDROLOGIC IMPACTS OF COAL DEVELOPMENT IN THE NARRAGANSETT BASIN, MASSACHUSETTS AND RHODE ISLAND,
Geological Survey, Boston, MA. Water Resources Div.
M. H. Frimpter, and A. Maevsky.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.60. Geological Survey Water-Supply Paper 2062, 1979. 35 p, 15 fig, 5 tab, 35 ref.

Descriptors: *Coal mines, *Effects, *Groundwater, *Hydrogeology, *Water quality, Coal mine wastes, Path of pollutants, Acidic water, Saline water intrusion, Tidal effects, Borehole geophysics, Aquifers, Water wells, Well data, Water yield, Drawdown, Water level fluctuations, Water analysis, Chemical analysis, Massachusetts, Rhode Island, *Narragansett Basin.

The hydrologic impacts of possible coal mining in the 900-square-mile Carboniferous Narragansett Basin in southeastern New England are described. Geophysical tests and hydrologic observations were made in thirteen 3-inch-diameter test holes which were 330 to 1,500 feet deep. Fractures and lithology, including graphite and coal, were identified and located from interpretation of geophysical logs. Ground-water levels measured in 1976-77 were less than 15 feet below land surface at all test sites. Specific capacities of the test holes to yield water ranged from 0.01 to 5.7 gallons per minute per foot of drawdown after short (2-5-hour) pumping periods. In a test hole in Halifax, Mass., water levels showing drawdown caused by pumping nearby domestic-supply wells indicate that mine dewatering would reduce yields of private wells tapping bedrock. In test holes near Narragansett Bay, ground water was brackish, and water levels fluctuated with about one-fifth the magnitude of the tide in the bay. These conditions suggest that there is potential for a high rate of mine seepage from the bay. As a result of mining, the iron disulfide minerals, pyrite and marcasite, react with air and water to produce acid water containing iron. However, acid mine water is not expected to be as serious a problem in the Narragansett Basin as it is in the Appalachian coal fields. No marcasite and only small amounts of coarsely crystalline pyrite have been observed in the metamorphosed sediments of the basin. (Woodard-USGS)
W79-09731

PRELIMINARY STUDY OF WASTEWATER MOVEMENT IN YELLOWSTONE NATIONAL

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PARK, WYOMING, OCTOBER 1976 THROUGH SEPTEMBER 1977,
Geological Survey, Cheyenne, WY. Water Resources Div.
E. R. Cox.
Geological Survey open-file report 79-684, March 1979. 59 p, 14 fig, 4 tab, 2 ref.

Descriptors: *Path of pollutants, *Sewage effluents, *Sewage lagoons, *Water analysis, Groundwater movement, Percolation, Chemical analysis, Water wells, Lakes, Streams, Water levels, *Yellowstone National Park(WY), Groundwater mounds.

Studies were made from October 1976 through September 1977 to determine the effects on lakes and streams of wastewater effluents that percolate from sewage lagoons at four sites in Yellowstone National Park. Ground-water mounds have built up under the lagoons as percolation of effluents occurred. Percolating effluents mix with ground water and move down the hydraulic gradient in a direction generally perpendicular to the water-level contours. Maps showing chloride and sulfate concentrations, specific conductance of water in wells, and water-level contours indicate the most likely areas and directions of movement of percolating effluents. (Woodard-USGS)
W79-09735

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1973-SEPTEMBER 1974,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 2L.
W79-09743

TRANSPORT MODELING IN THE ENVIRONMENT USING THE DISCRETE-PARCEL-RANDOM-WALK APPROACH,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2F.
W79-09750

THE RELATIONSHIP BETWEEN RAINFALL AND NEMATODE DENSITY IN DRINKING WATER,
George Mason Univ., Fairfax, VA. Dept. of Biology.
A. S. Tombes, A. R. Abernathy, D. M. Welch, and S. A. Lewis.
Water Research, Vol. 13, No. 7, p 619-622, 1979. 2 fig, 2 tab, 14 ref. EPA R804292010.

Descriptors: *Nematodes, *Potable water, *Rainfall, On-site investigation, Water pollution, Water treatment, Reservoirs, Rivers, Analysis, Data collections.

A 12 month study of the source of the nematodes was carried out to determine: (1) if they were breeding within the treatment facility, i.e., sand filter, settling basin, or piping; or (2) if they were breeding in the surface water of some point upstream and were entering with the raw water and surviving the purification and filtering processes. A direct relationship exists between rainfall, streamflow, and turbidity and the density of nematodes in drinking water. During rainy periods, the density of nematodes increases from 1 to 15/gal of finished water. This supports the hypothesis that the nematodes are not breeding within the water treatment facility but are entering the municipal water system with the raw water. (Humphreys-ISWS)
W79-09753

THE ATMOSPHERIC CONTRIBUTION OF PHOSPHORUS TO AN AQUATIC SYSTEM,
Williams Bros. Engineering Co., Tulsa, OK.
R. F. Sober, and M. H. Bates.
Water, Air, and Soil Pollution, Vol. 11, No. 1, p 63-69, January 1979. 5 fig, 10 ref.

Descriptors: *Lakes, *Water pollution sources, *Fallout, *Oklahoma, Water quality, Phosphorous, Pollutants, Atmosphere, Sampling, On-site investigations, Instrumentation, Analysis, *Lake Carl Blackwell(OK).

Samplers designed to collect bulk atmospheric fallout were located at three sites around Lake Carl Blackwell, Oklahoma, in order to gather data regarding the atmospheric contribution of P to the lake. Based on the data collected, it was determined that the atmosphere is a definite source of P to Lake Carl Blackwell. It was also concluded that P quantities, as a general trend, increased as the volume of precipitation increased and that atmospheric contributions vary with sampler location. Based on the average annual atmospheric P contribution and the average calculated surface area and lake volume, it was determined that the atmosphere can become a significant non-point source of P to this aquatic system. When considering the monthly contribution of P to the lake (based on the monthly average of samples as previously presented and assuming no appreciable outflow of P), a concentration of 1.30 ppb could be achieved. The total P concentration, based on the annual atmospheric contribution, could reach as high as 15.0 ppb. However, it should be noted that 65% of the total annual contribution occurred during the month of May. (Humphreys-ISWS)
W79-09755

POTENTIAL OF THE OHRID RIFLE MINNOW, ALBURNOIDES BIPUNCTATUS OHRIDANUS, AS AN INDICATOR OF POLLUTION,
Arizona State Univ., Tempe. Dept. of Zoology.
W. W. Taylor, and S. D. Gerking.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 4, p 2178-2181, 1978. 2 tab, 4 ref.

Descriptors: Freshwater fish, Benthic algae, *Minnows, Domestic waste, *Domestic pollution, *Water pollution effects, Lake Ohrid, Jugoslavia, Substrate, Rifle minnow, Water temperature, Seasonal distribution, On-site-investigation, Ohrid rifle minnow, *Pollution indicator.

The abundance of the rifle minnow (Alburnoides bipunctatus) was great in areas enriched by domestic wastes on all substrate types. Enriched ones were occupied by eight times as many minnow as unenriched. The rifle minnow prefers sandy and rocky substrates. Enriched areas attract especially heavy numbers of fish. The nutrient from the sewage stimulate a luxurient growth of benthic algae (mostly spirogyra) which is a primary food of the rifle minnow. In the coldest weather the minnow was only found near towns which indicates that the higher temperature of the effluent may also attract the fish. (Katz-EIS)
W79-09774

EFFECT OF A TROPICAL SWAMP ON WATER QUALITY,
Nairobi Univ. (Kenya). Dept. of Botany.
For primary bibliographic entry see Field 5A.
W79-09775

EFFECT OF CALCIUM IN WATER ON PHOSPHORUS METABOLISM IN FISH TISSUES,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5A.
W79-09776

A MORPHOMETRIC STUDY OF EFFECTS OF NICKEL, CHROMIUM AND CADMIUM ON THE SECONDARY LAMELLAE OF RAINBOW TROUT GILLS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
For primary bibliographic entry see Field 5A.
W79-09781

IDENTIFICATION OF SUBSTANCES TRANSFERRED TO FISH OR SHELLFISH FROM PETROLEUM SUSPENSION,
Okayama Univ. (Japan). Dept. of Public Hygiene.
For primary bibliographic entry see Field 5A.
W79-09782

BIOACCUMULATION AND ELIMINATION OF COPPER IN THE ROCK OYSTER CRASSOSTREA CUCULLATA,
National Inst. of Oceanography, Goa (India).
For primary bibliographic entry see Field 5A.
W79-09787

THE VALUE AND LIMITATIONS OF VARIOUS APPROACHES TO THE MONITORING OF WATER QUALITY FOR FRESHWATER FISH,
Food and Agriculture Organization of the United Nations, Rome (Italy) EIFAC Working Party on Biological Monitoring.
For primary bibliographic entry see Field 5A.
W79-09791

PHOSPHORUS IN THE WATER, SEDIMENT, AND VEGETATION OF THE CRNOJEVICA RIVER, MONTENEGRO, YUGOSLAVIA,
Hobart and William Smith Colleges, Geneva, NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-09792

LIMNOLOGY OF RUTLAND WATER,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.
For primary bibliographic entry see Field 5A.
W79-09793

RANGE OF CHANGES IN FISHPOND ENVIRONMENT INFLUENCED BY INTENSIVE CARP FARMING,
Polish Academy of Sciences, Golysz. Fish Culture Station.
For primary bibliographic entry see Field 5A.
W79-09796

EFFECTS OF ANTHROPOGENIC FACTORS ON THE ZONAL DISTRIBUTION OF FISHES IN THE DANUBE RIVER SYSTEM IN SERBIA (YUGOSLAVIA),
Institute for Biological Research, Belgrade (Yugoslavia).
D. Jankovic.
Verhandlunger Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 4, p. 2150-2153, 1978. 6 ref, 1 fig.

Descriptors: Freshwater fish, *Water pollution effects, Water pollution sources, *Industrial wastes, *Domestic wastes, *Mining, Mining wastes, *Silting, Erosion, Jugoslavia, Danube River, Commercial fish, Sturgeon, Salmonids, Reservoirs, Dams.

Rivers in Serbia are being polluted by industrial, mining, domestic wastes, and erosion. Reservoirs resulting from dam construction and intensive over-fishing have affected the fisheries. Resistant fish species (Chondrostoma nasus, Leuciscus cephalus) have moved into impacted areas while some of the economically valuable fish have become restricted or have disappeared. These include sturgeons, salmonids, and grayling. (Katz-EIS)
W79-09797

CHRONIC EXPOSURE OF TROUT TO WATERS WITH NATURALLY HIGH SELENIUM LEVELS: EFFECTS ON TRANSFER RNA METHYLATION,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 5A.
W79-09799

BIOACCUMULATION OF MERCURY IN SARCOSAPROPHAGOUS INSECTS,
Helsinki Univ. (Finaind). Dept. of Environmental Science.
For primary bibliographic entry see Field 5A
W79-09801

DECREASE IN MERCURY CONTENT OF FISHES IN BALL LAKE, ONTARIO, SINCE IMPOSITION OF CONTROLS ON MERCURY DISCHARGES,
Fisheries and Marine Service, Winnipeg (Manitoba). Dept. of Fisheries and Ocean.
F. A. J. Armstrong, and D. P. Scott.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 670-672, 1979.

Descriptors: *Mercury, *Heavy metals, *Path of pollutants, *Ball Lake(Ontario), *Freshwater fish, *Water pollution sources, *Pollution abatement, Walleye, Northern Pike, Lake Whitefish, Stizostedion, Esox, Coregonus, Pikes, Growth, Water pollution effects.

Weight, fork length, and white muscle mercury concentrations of walleye (Stizostedion vitreum vitreum), northern pike (Esox lucius), and lake whitefish (Coregonus clupeaformis) from Ball Lake, northwestern Ontario, were compared for 1971, 1972, and 1976. The lake had received mercury from 1962 to 1970; since then there have been increasingly rigorous controls. Adjusted mean white muscle mercury concentrations for walleye at the group mean length of 444 mm were 1.99, 2.71, and 1.39 mm /kg, respectively, for the three sample years. Corresponding values for pike 594 mm long were 5.05, 5.72, and 1.80 mg/kg. Whitefish values for 1972 and 1976 were 0.62 and 0.42 at 441 mm fork length. The changes are discussed in relation to the decreased input of mercury to the lake and it is suggested that mercury in suspension may be a controlling factor. (D. Katz-EIS)
W79-09804

PHYSIOLOGICAL AND BIOCHEMICAL ASPECTS OF OZONE TOXICITY TO RAINBOW TROUT (SALMO GAIRDNERI),
Fish and Wildlife Service, Seattle WA.; and National Fisheries Research Center, Seattle, WA.; and Naval Support Activity, Seattle, WA.
G. A. Wedemeyer, N. C. Nelson, and W. T. Yasutake.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 605-614, 1979. 7 fig, 4 tab, 22 ref.

Descriptors: *Ozone, *Fish toxicity, *Salmo gairdneri, *Rainbow trout, *Salmonids, *Bioassay, *Lethal limit, *Toxicity, *Aquiculture, *Disease control, *Pesticides, *Fish physiology, Fish disease, Pathology, Mortality, Water pollution sources, Fish behavior, Water pollution effects, Histology, Gill damage, Blood discrasias, Laboratory tests.

The acute toxicity curve for dissolved ozone (03) in soft water at 10 degrees C, using 10-13 cm rainbow trout (Salmo gairdneri) was calculated. The 96-h LC50 was 9.3 (8.1-10.6) micrograms/1. The lethal threshold level was 8 microgram/1 mandating that a conservative margin of safety be used if ozone is employed as a fish disease control agent. Death apparently results from massive destruction of the gill lamellar epithelium together with a severe hydromineral imbalance. In partial chronic (3-month) testing, 2 microgram/1 caused no significant biological damage while 5 microgram/1 caused some gill pathological changes, and reduced feeding behavior. 2 microgram/1 is suggested as a provisional maximum safe exposure level, pending completion of life cycle studies. If ozone treated water is discharged into the environment, dissolved 03 should be reduced to at least this level to minimize adverse impacts on salmonids in receiving waters. (D. Katz-EIS)
W79-09806

ROLE OF TUBIFICID WORMS ON NITROGEN TRANSFORMATIONS IN STREAM SEDIMENT,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
L. Chatarpaul, J. B. Robinson, and N. K. Kaushik.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 673-678, 1979. 2 tab, 3 fig, 19 ref.

Descriptors: *Nitrogen cycle, *Tubificids, *Sediments, *Streambeds, *Nitrification, *Denitrification, *Water quality, Benthos, Annelids, Nitrogen, Nitrogen fixation, Streams, Tubifex, Limnodrilus, Benthic fauna, Aquatic animals, Worms.

Sediments obtained from Swifts Brook were highly organic whereas those from Canagagigue Creek were coarse-textured with relatively little organic content. Columns of sediment were overlain with continuously aerated 10 mg/L nitrate-N solution or distilled water. When columns of Canagagigue sediment with tubificids (Tubifex tubifex and Limnodrilus hoffmeisteri) were incubated for 33 d they lost nitrate-N at a significantly higher rate than did columns without worms. Following the initial period of nitrate disappearance (resulting from dentrification in the sediment) nitrate-N increased again, this increase being greatest in the presence of worms. The increasing concentration of nitrate-N probably resulted from nitrification which was masked early in the experiment by rapid denitrification. In columns with Swifts Brook sediment, added nitrate disappeared rapidly but no significant difference was observed between the columns with worms and those without; nitrate-N concentration was never observed to increase. Possibly both nitrification and denitrification are also enhanced here by the presence of tubificids but the effects are masked. (D. Katz-EIS)
W79-09807

COLONIZATION AND STANDING CROPS OF EPILITHIC ALGAE IN THE SUSQUEHANNA RIVER, PENNSYLVANIA,
Ichthyological Associates, Inc., Berwick, PA.
W. F. Gale, A. J. Gurzynski, and R. L. Lowe.
Journal of Phycology, Vol. 15, p 117-123, 1979. 5 fig, 3 tab, 19 ref.

Descriptors: *Standing crop, *Susquehanna River(Pennsylvania), *Algae, *Seasonal, *Colonization, *Coal mine wastes, *Aquatic algae, Artificial substrate, Rivers, Mine wastes, Coal mines, Diatoms, Iron, Epilithic algae, Sampling, Analytical techniques, On-site data collections, Methodology, Cyanophyta, Chlorophyta, Primary productivity, Productivity.

A scuba diver, using a bar-clamp sampler, collected quantitative epilithic algae samples from artificial substrates (slate and acrylic plates) and river stones at two stations on the Susquehanna River bottom in 1974. At Falls, Pennsylvania, algal colonization on monthly plates (submerged for ca. 30 day periods) was most rapid between September and October. In winter, when algal density on cummulative plates (submerged 2-13 mo) and on stones present in the river peaked at 18,100 and 21,900 units/sq mm, respectively, colonization of clean monthly plates nearly ceased. Similar colonization patterns were observed in a portion of the river polluted by coal mine drainages (SSES), but expansion of the algae population at SSES was inhibited by iron in the effluents, and densities never exceeded 2,400 units/sq mm on stones or plates. Diatoms composed 95% of the overall standing crop at Falls and 65% at SSES. (D. Katz-EIS)
W79-09811

EFFECTS OF ACIDIC PRECIPITATION ON PRECAMBRIAN FRESHWATERS IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Rexdale. Water Resources Branch.
For primary bibliographic entry see Field 5A.
W79-09812

POLYNUCLEAR AROMATIC HYDROCARBONS IN BALTIMORE CANYON FISH,
Exxon Research and Engineering Co., Linden, NJ. Analytical and Information Div.
R. A. Brown, and R. J. Pancirov.
Environmental Science and Technology, Vol. 13, p 878-879, 1979. 1 fig, 1 tab, 7 ref.

Descriptors: *Baltimore Canyon, *Polynuclear aromatic hydrocarbons, *Baseline studies, *Marine fish, Shellfish, *Sea bass, *Pollutants, *Organic compounds, Oil, Oil pollution, Oil industry, Public health, Water quality, Scup, Path of pollutants, Water quality control, Monitoring, Flounder, Red hake, Butterfish, Sea scallops, Tissue analysis, Aromatic compounds.

Concentrations of polynuclear aromatic hydrocarbons (PNAs) were determined in six summer flounder, scup, black sea bass, butterfish, sea scallops, and red hake from the Baltimore Canyon. This information will be useful as base-line data for evaluating the effects of exploration and possible production of oil and/or gas off the east coast of the U.S. on the level of PNAs in the fish population. This is significant public health concern because some of these hydrocarbons are potential carcinogens. (D. Katz-EIS)
W79-09813

ON THE HEAVY METALS AND CHLORINATED HYDROCARBONS IN THE GULF OF BOTHNIA IN FINLAND,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 5A.
W79-09814

EFFECTS OF ZINC ON JUVENILE ATLANTIC SALMON SALMO SALAR: ACUTE TOXICITY, FOOD INTAKE, GROWTH AND BIOACCUMULATION,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-09816

SEASONAL VARIATION OF ZINC IN THE BARNACLE, BALANUS BALANOIDES (L.) MAINTAINED ON A RAFT IN THE MENAI STRAIT,
Natural Environment Research Council, Bangor (Wales). Marine Invertebrate Biology Unit.
For primary bibliographic entry see Field 5A.
W79-09817

BIOACCUMULATING SUBSTANCES--MAINLY DDT AND PCB--IN BIOTA IN THE GULF OF BOTHNIA,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
For primary bibliographic entry see Field 5A.
W79-09818

THE ACCUMULATION OF RADIOACTIVE CAESIUM FROM FOOD BY THE PLAICE PLEURONECTES PLATESSA AND THE BROWN TROUT (SALMO TRUTTA),
Ministry of Agriculture, Fisheries and Food Lowestoft (England).
C. J. Hewett, and D. F. Jefferies.
Journal of Fish Biology, Vol. 13, p 143-153, 1978. 9 tab, 20 ref.

Descriptors: *Metals, *Marine fish, *Freshwater fish, *Caesium, Brown trout, Radioactivity, Radioactive caesium, Caesium 137, Methodology, Path of pollutants, Water pollution effects, Fish diets, Fish food organisms.

The patterns of accumulation of caesium-137 from food by the tissues and organs of a marine teleost, the plaice and a freshwater teleost, the brown trout are described and compared. Estimates of the biological half-times and steady-state concentrations are derived and individual organ intakes calculated. Rate constants are similar to those obtained from the accumulation from water studies. Plaice gut and liver have an 11% increase and trout gut a 6% increase in their share of the (137CS) intake arising from accumulation from food, compared with that arising from the accumulation from water. These increases were balanced by decreases in the muscle share of the intake. The overall absorption of (137CS) from food was 42% for plaice and 67% for trout. (Katz-EIS)
W79-09819

GROWTH AND DETACHMENT OF PERIPHYTON IN AN EFFLUENT FROM THE SECONDARY TREATMENT PLANT OF WASTEWATERS,

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LIBRARY

Shimane Univ. (Japan). Dept. of Agricultural Chemistry.
H. Ohtake, S. Aiba, and R. Sudo.
The Japanese Journal of Limnology, Vol. 39, No. 4, p 163-169, 1978. 3 tab, 5 fig, 6 ref.

Descriptors: *Plant growth, *Periphyton, *Sessile algae, *Waste water treatment, *Effluent streams, *Aquatic microorganisms, *Water pollution effects, *Degradation(Decomposition), *Primary productivity, Waste treatment, Water treatment, Effluents, Water pollution, Water quality, Tama River(Japan), Benthic Flora, Benthos, Industrial wastes, Sewage treatment, Sewage effluents, Water pollution sources, Biological communities, Artificial water courses, Biomass.

Growth, followed by detachment of periphyton was observed in an artificial stream receiving effluent from a secondary wastewater treatment plant. The cycle of growth and detachment was more conspicuous in summer (water temperature ranged nearly from 24 to 26 C) than in winter (water temperature from 12 to 19 C). This cycle was accompanied by a succession of dominant species of microorganisms in the periphyton. In light of this work, the considerable pollution caused by periphyton in the Tama River, a shallow stream, running through metropolitan Tokyo, was discussed. (D. Katz-EIS)
W79-09820

RIVER POLLUTION FROM A LARGE TROUT FARM IN NORWAY,
Fiskeridirektoratets Kjemisk-Tekniske Forskningsinstitutt, Bergen (Norway).
For primary bibliographic entry see Field 5A.
W79-09821

A SURVEY OF HEAVY METALS IN THE SURF CLAM, SPISULA SOLIDISSIMA, AND THE OCEAN QUAHOG, ARCTICA ISLANDICA, OF THE MID-ATLANTIC COAST OF THE UNITED STATES,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
For primary bibliographic entry see Field 5A.
W79-09824

FAUNAL CHANGES IN THE SEVERN ESTUARY OVER SEVERAL DECADES,
University Coll., Cardiff (Wales). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-09825

PATTERNS OF ORGANOCHLORINE RESIDUES IN ANIMALS OF DIFFERENT TROPHIC LEVELS FROM THE WESER ESTUARY,
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
H. Goerke, G. Eder, K. Weber, and W. Ernst.
Marine Pollution Bulletin, Vol. 10, p 127-132, 1979. 4 fig, 4 tab, 22 ref.

Descriptors: *Pesticide residues, *Chlorinated hydrocarbon pesticides, *DDD, *DDE, *Dieldrin, *Polychlorinated biphenyls, Pesticides, Arenicola, Crangon, Cerastoderma, Solea, Mya, Biomagnification, Path of pollutants, Trophic levels, Food chains, Food webs, Bioaccumulation, On-site investigations, Sampling, Shrimp, Clam, Sole, North Sea.

Four invertebrate and one fish species (Cerastoderma edule, Mya arenaria, Arenicola marina, Crangon crangon, Solea solea) from a single area of the German North Sea were investigated for concentrations of ten organochlorine pollutants in 1976. PCB concentrations (wet tissue basis) were predominating with 10-200 ng/g, while DDD, dieldrin, alpha-HCH, gamma-HCH and DDE generally ranged between 1 and 10 ng/g. Values of alpha-endosulfan were even lower; DDT, endrin and heptachlor epoxide could not be detected. Residue levels in shrimps were close to the lower range of values which have been found in this species from other areas of the North Sea since 1974. The patterns of residue concentrations in the five aquatic species were remarkably different indicating species-and compound-specific bioaccumulation. Trophic level and lipid content were shown to be responsible for PCB concentrations increasing from bivalves to fish. (D. Katz-EIS)
W79-09826

5C. Effects Of Pollution

SEASONALLY DISPLACED WATER TEMPERATURES AS A FACTOR AFFECTING DEPLETION OF STORED CARBOHYDRATES IN TYPHA LATIFOLIA,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
B. Bedford.
In: Wetland: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 83-98, (1978) 6 fig, 1 tab, 20 ref.

Descriptors: *Cattails, *Thermal pollution, *Effects, Temperature, Wetlands, Utilities, Seasonal, Groundwater, Carbohydrates.

Common cattail, Typha latifolia, exhibited both positive and negative responses to altered thermal regimes associated with leakage from the cooling lake of the Columbia Electric Generating Station in south central Wisconsin. Minimal temperature elevations resulted in early spring growth and rapid increases in shoot densities. Winter groundwater temperatures comparable to summer temperature patterns results in population decrease due to the exhaustion of over-wintering carbohydrate reserves available in Typha rhizomes for spring shoot production and growth. Groundwater temperatures never exceeded those normally attained in summer. They were merely displaced in time to winter due to delayed movement through the peat. Results to date of this study suggest the critical nature of the timing of thermal stress, in addition to the magnitude. This is particularly relevant for northern populations of perennial plants. The study also predicts a reversal in the overall positive response of Typha latifolia to thermal discharges. (See also W79-09581) (Stihler-Mass)
W79-09588

TIMBER HARVESTING PRACTICES AND WATER QUALITY IN THE EASTERN UNITED STATES,
Northeastern Forest Experiment Station, Pennington, NJ.
For primary bibliographic entry see Field 4D.
W79-09590

CAUSES OF OYSTER LARVAE MORTALITY IN SOUTH PUGET SOUND,
Washington State Dept. of Fisheries, Olympia.
For primary bibliographic entry see Field 5B.
W79-09660

ROLE OF THE BLUE-GREEN ALGA NOSTOC MUSCORUM AS A POSSIBLE NITRATE SOURCE TO THE GROUNDWATERS OF GUAM,
Guam Univ., Agana. Water Resources Research Center.
D. A. Grosenbaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 954, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 9, July 1979. 53 p, 13 fig, 11 tab, 19 ref. OWRT A-010-GUAM(1). 14-34-0001-8012.

Descriptors: *Groundwater, Nitrates, Limestone, Karst, *Blue-green algae, Guam, Nostoc muscorum.

An investigation of the nitrogen-fixing blue-green alga Nostoc muscorum Ag. as a possible contributor of nitrate to the groundwater of Guam was carried out from October 1977 to January 1979. Total potential nitrate contribution was determined by combining data obtained for ammonia excretion (a maximum of 1.39 micrograms NH4/g Nostoc/hr), percent nitrogen (3.38%) and growth rates (40% increase/wk) with algal biomass estimates for Guam (2.6 x 10 to the sixth power kg) to obtain a value of 1.5 micrograms NO3-N/ml rainwater. Soil percolate studies were similarly extrapolated to produce a corresponding value of 6.5 x 1/10,000 micrograms NO3-N/ml rainwater. Both values are well below those obtained from the groundwater, i.e., ca. 2 micrograms NO3-N/ml. It is concluded that Nostoc muscorum does not contribute significantly to the high nitrate content of Guam's groundwater.
W79-09676

A REVIEW OF SURVIVAL RATES OF FISH EGGS AND LARVAE IN RELATION TO IMPACT ASSESSMENTS,
NUS Corp., Pittsburgh, PA. Northern Environmental Services Div.
For primary bibliographic entry see Field 5A.
W79-09773

POTENTIAL OF THE OHRID RIFLE MINNOW, ALBURNOIDES BIPUNCTATUS OHRIDANUS, AS AN INDICATOR OF POLLUTION,
Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-09774

INFLUENCE OF DISPERSANTS ON THE EMBRYONIC DEVELOPMENT OF THE SEA URCHIN STRONGLYOCENTROTUS NUDUS,
Akademiya Nauk SSSR, Vladivostok. Inst. Morskogo Biologii.
For primary bibliographic entry see Field 5A.
W79-09777

A MORPHOMETRIC STUDY OF EFFECTS OF NICKEL, CHROMIUM AND CADMIUM ON THE SECONDARY LAMELLAE OF RAINBOW TROUT GILLS,
Bristol Univ. (England). Research Unit for Comparative Animal Respiration.
For primary bibliographic entry see Field 5A.
W79-09781

IDENTIFICATION OF SUBSTANCES TRANSFERRED TO FISH OR SHELLFISH FROM PETROLEUM SUSPENSION,
Okayama Univ. (Japan). Dept. of Public Hygiene.
For primary bibliographic entry see Field 5A.
W79-09782

ICHTHYOTOXICITY OF A FLAGELLATE UROGLENA VOLVOX,
Tokyo Univ. (Japan). Lab. of Marine Biochemistry.
For primary bibliographic entry see Field 5A.
W79-09783

COMPARATIVE ALGICIDE EVALUATIONS USING LABORATORY AND FIELD ALGAE,
Florida International Univ., Miami. Drinking Water Quality Research Center.
For primary bibliographic entry see Field 5A.
W79-09786

BIOACCUMULATION AND ELIMINATION OF COPPER IN THE ROCK OYSTER CRASSOSTREA CUCULLATA,
National Inst. of Oceanography, Goa (India).
For primary bibliographic entry see Field 5A.
W79-09787

THE VALUE AND LIMITATIONS OF VARIOUS APPROACHES TO THE MONITORING OF WATER QUALITY FOR FRESHWATER FISH,
Food and Agriculture Organization of the United Nations, Rome (Italy) EIFAC Working Party on Biological Monitoring.
For primary bibliographic entry see Field 5A
W79-09791

PHOSPHORUS IN THE WATER, SEDIMENT, AND VEGETATION OF THE CRNOJEVICA RIVER, MONTENEGRO, YUGOSLAVIA,
Hobart and William Smith Colleges, Geneva, NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-09792

EFFECTS OF PUMPED STORAGE OPERATIONS ON ROTIFER POPULATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-09794

ATTACHED ALGAE AT THERMAL GENERATING STATIONS -- THE EFFECT OF TEMPERATURE ON CLADOPHORA,
Ontario Ministry of the Environment, Toronto. Water Resources Branch.
For primary bibliographic entry see Field 5A.
W79-09795

EFFECTS OF ANTHROPOGENIC FACTORS ON THE ZONAL DISTRIBUTION OF FISHES IN THE DANUBE RIVER SYSTEM IN SERBIA (YUGOSLAVIA),
Institute for Biological Research, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 5B.
W79-09797

CHRONIC EXPOSURE OF TROUT TO WATERS WITH NATURALLY HIGH SELENIUM LEVELS: EFFECTS ON TRANSFER RNA METHYLATION,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 5A.
W79-09799

BIOACCUMULATION OF MERCURY IN SARCOSAPROPHAGOUS INSECTS,
Helsinki Univ. (Finalnd). Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W79-09801

TEMPERATURE PREFERENCE OF THE WHITE PERCH, MORONE AMERICANA, COLLECTED IN THE WICOMICO RIVER, MARYLAND,
Frostburg State Coll., MD. Center for Environmental and Estuarine Studies.
For primary bibliographic entry see Field 5A.
W79-09802

INTERTIDAL CATASTROPHES: EFFECT OF STORMS AND HURRICANES ON INTERTIDAL BENTHOS OF THE MINAS BASIN, BAY OF FUNDY,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
R. K. Yeo, and M. J. Risk.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 667-669, 1979. 4 fig, 9 ref.

Descriptors: *Secondary productivity, *Benthos, *Intertidal areas, *Storms, *Hurricanes, *Minas Basin(Bay of Fundy), *Intertidal productivity, *Estuaries, Aquatic habitats, Beaches, Environmental effects, Mortality, Productivity, Food chains, Sampling, On-site investigations, Erosion, Biological communities, Populations, Macoma.

Hurricane Beulah (July 1975) and a major storm both caused catastrophic mortalities among intertidal benthos of the Minas Basin. In both events, surface sediment was scoured off the flats, resulting in high mortalities in shallow-burrowing organisms. The storm was a more severe catastrophe than the hurricane. The demonstrated high secondary productivity of these flats is difficult to reconcile with these observations; extensive lateral migration of the benthos may aid in recovery from catastrophe. (Katz-EIS)
W79-09803

DECREASE IN MERCURY CONTENT OF FISHES IN BALL LAKE, ONTARIO, SINCE IMPOSITION OF CONTROLS ON MERCURY DISCHARGES,
Fisheries and Marine Service, Winnipeg (Manitoba). Dept. of Fisheries and Ocean.
For primary bibliographic entry see Field 5B.
W79-09804

ACUTE AMMONIA TOXICITY AND AMMONIA EXCRETION IN RAINBOW TROUT (SALMO GAIRDNERI),
British Columbia Univ., Vancouver. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-09805

PHYSIOLOGICAL AND BIOCHEMICAL ASPECTS OF OZONE TOXICITY TO RAINBOW TROUT (SALMO GAIRDNERI),
Fish and Wildlife Service, Seattle WA.; and National Fisheries Research Center, Seattle, WA.; and Naval Support Activity, Seattle, WA.
For primary bibliographic entry see Field 5B.
W79-09806

PHYTOPLANKTON RECOVERY AFTER POWER PLANT ENTRAINMENT,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 5A.
W79-09808

INFLUENCE OF FRESHWATER INTRUSION ON MICROBIAL BIOMASS IN SALT-MARSH CREEKS,
South Carolina Univ., Columbia. Dept. of Biology.
R. T. Weiland, T. H. Chrzanowski, and L. H. Stevenson.
Estuaries, Vol. 2, No. 2, p 126-129, 1979. 3 tab, 1 fig, 10 ref.

Descriptors: *Biomass, *Aquatic microorganisms, *Salinity, *Tidal marshes, *Productivity, *Salt marshes, *Streams, Water quality, Standing crops, Water temperature, Organic matter, Marshes, Saline water, Monitoring, On-site investigations, Particulate organic carbon, North Inlet South Carolina.

Adenosine triphosphate (ATP), particulate organic carbon (POC), pH, temperature, and salinity associated with the water column of several salt marsh creeks were monitored at 5 stations for 8 months. A gradient in mean salinity of 11.5 ppth to 32.7 ppth was observed in the creeks. No significant correlations could be found among the variables measured at the station with the highest salinity. ATP and POC were found to be positively correlated at all other stations. Salinity was found to be negatively correlated with both ATP and POC only at a station with the second highest mean salinity (28.8 ppth) and could account for only 45.7% of the variation in ATP. The lack of significant correlations between salinity and ATP as well as the inability of salinity to account for a large portion of the variation in ATP suggested that salinity had little relationship to the level of total microbial mass. (D. Katz-EIS)
W79-09809

EFFECT OF FISH AGE ON PREDICTED AND OBSERVED CHRONIC TOXICITY OF LEAD TO RAINBOW TROUT IN LAKE ONTARIO WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W79-09810

COLONIZATION AND STANDING CROPS OF EPILITHIC ALGAE IN THE SUSQUEHANNA RIVER, PENNSYLVANIA,
Ichthyological Associates, Inc., Berwick, PA.
For primary bibliographic entry see Field 5B.
W79-09811

EFFECTS OF ACIDIC PRECIPITATION ON PRECAMBRIAN FRESHWATERS IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Rexdale. Water Resources Branch.
For primary bibliographic entry see Field 5A.
W79-09812

POLYNUCLEAR AROMATIC HYDROCARBONS IN BALTIMORE CANYON FISH,
Exxon Research and Engineering Co., Linden, NJ. Analytical and Information Div.
For primary bibliographic entry see Field 5B.
W79-09813

ON THE HEAVY METALS AND CHLORINATED HYDROCARBONS IN THE GULF OF BOTHNIA IN FINLAND,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 5A.
W79-09814

EFFECTS OF ZINC ON JUVENILE ATLANTIC SALMON SALMO SALAR: ACUTE TOXICITY, FOOD INTAKE, GROWTH AND BIOACCUMULATION,
Fisheries and Marine Service, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5A.
W79-09816

BIOACCUMULATING SUBSTANCES--MAINLY DDT AND PCB--IN BIOTA IN THE GULF OF BOTHNIA,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
For primary bibliographic entry see Field 5A.
W79-09818

THE ACCUMULATION OF RADIOACTIVE CAESIUM FROM FOOD BY THE PLAICE PLEURONECTES PLATESSA AND THE BROWN TROUT (SALMO TRUTTA),
Ministry of Agriculture, Fisheries and Food Lowestoft (England).
For primary bibliographic entry see Field 5B.
W79-09819

GROWTH AND DETACHMENT OF PERIPHYTON IN AN EFFLUENT FROM THE SECONDARY TREATMENT PLANT OF WASTEWATERS,
Shimane Univ. (Japan). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 5B.
W79-09820

RIVER POLLUTION FROM A LARGE TROUT FARM IN NORWAY,
Fiskeridirektoratets Kjemisk-Tekniske Forskningsinstitutt, Bergen (Norway).
For primary bibliographic entry see Field 5A.
W79-09821

EFFECT OF SOLVENTS ON IN VITRO PESTICIDES INHIBITION OF ATPASE IN CERTAIN TISSUES OF LABEO ROHITA,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-09822

A SURVEY OF HEAVY METALS IN THE SURF CLAM, SPISULA SOLIDISSIMA, AND THE OCEAN QUAHOG, ARCTICA ISLANDICA, OF THE MID-ATLANTIC COAST OF THE UNITED STATES,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
For primary bibliographic entry see Field 5A.
W79-09824

Group 5C—Effects Of Pollution

FAUNAL CHANGES IN THE SEVERN ESTUARY OVER SEVERAL DECADES,
University Coll., Cardiff (Wales). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-09825

PATTERNS OF ORGANOCHLORINE RESIDUES IN ANIMALS OF DIFFERENT TROPHIC LEVELS FROM THE WESEk ESTUARY,
Institut fuer Meeresforschung, Bremerhaven (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W79-09826

A POSSIBLE METHOD FOR THE DETECTION OF POLLUTION-INDUCED DISTURBANCE ON MARINE BENTHIC COMMUNITIES,
Oslo Univ. (Norway). Inst. of Marine Biology.
J. S. Gray, and F. B. Mirza.
Marine Pollution Bulletin, Vol. 10, p 142-146, 1979. 4 fig, 3 tab, 14 ref.

Descriptors: *Biological communities, *Spatial distribution, *Temporal distribution, *Benthos, *Aquatic populations, *Mathematical models, Distribution, Distribution patterns, Benthic flora, Benthic fauna, Water pollution effects, Environmental effects, Aquatic life, Ecological distribution, Ecosystems, Habitats, Succession, Scotland.

In polluted areas the log-normal distribution of individuals per species fits well data from many benthic communities. Using a simple plotting method, under slight pollution the data show a distinct break in the normally straight line log-normal plot and the plot covers more geometric classes than data from unpolluted areas. Under more severe pollution stress the data show a return to a log-normal distribution, but with a shallower slope, and span more geometric classes than data from less polluted areas. The above-mentioned patterns are consistent for spatial effects of pollution in Oslofjord and for temporal effects in data from a Scottish sea loch and also apply to other communities. An explanation of the reasons for such patterns is given and consideration given to the robustness of and application of the methods described. (D. Katz-EIS)
W79-09827

THE CYTOLOGY AND OCCURRENCE OF GRANULOCYTOMAS IN MUSSELS,
Institute for Marine Environmental Research, Plymouth (England).
D. M. Lowe, and M. N. Moore.
Marine Pollution Bulletin, Vol. 10, p 137-141, 1979. 1 tab, 9 fig, 18 ref.

Descriptors: *Animal pathology, *Diseases, *Mussels, *Mytilus edulis, *Shellfish, *Commercial shellfish, *Granulocytomas, Invertebrates, Water pollution sources, Water pollution effects, Industrial wastes, Domestic wastes, Water quality, Microscopy, Histology, Animal physiology, Digestion, Pollutants, Inflammatory lesion, England, Wales.

A non-neoplastic inflammatory cellular condition in the marine mussel Mytilus edulis is described and a possible relationship drawn between its incidence and water quality as effected by chronic insult by domestic and industrial waste products. This conditions, termed a granulocytoma owing to its dominant constituent cell type, is capable of overcoming host encapsulation and inducing atrophy and autolysis of the digestive gland and may therefore represent a terminal condition. (D. Katz-EIS)
W79-09828

EFFECTS OF CHRONIC CADMIUM EXPOSURE ON CRAYFISH SURVIVAL, GROWTH, AND TOLERANCE TO ELEVATED TEMPERATURES,
Savannah River Ecology Lab., Aiken, SC.
J. H. Thorp, J. P. Giesy, and S. A. Wineriter.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 4, p 449-456, 1979. 1 fig, 2 tab, 30 ref. DOE EY-76-C-09-0819.

Descriptors: *Environmental effects, *Water pollution, Cadmium, Crayfish, Mortality, Growth rates, Absorption, Temperature, Thermal stress, Resistance, Thermal tolerance.

Uptake of cadmium, growth, and mortality were measured on crayfish which had been exposed to concentrations of 0.02, 5, and 10 microg/l Cd in a continuous flow system for a 5-month period. At the end of the 5-month period, one-half of the crayfish were analyzed for Cd levels and the other half were exposed in a static laboratory experiment to stepwise, daily increases in temperature. It was found that the rate of Cd uptake was positively related to the concentration of the metal in the external environment. Mortality increased significantly with higher Cd concentrations. Growth and thermal tolerance did not appear to be significantly related to Cd concentration in tissues of the crayfish. (Chilton-ORNL)
W79-09829

5D. Waste Treatment Processes

WETLANDS: ECOLOGY, VALUES, AND IMPACTS, PROCEEDINGS OF THE WAUBESA CONFERENCE ON WETLANDS, JUNE 2-5, 1977, MA DISON, WISCONSIN.
For primary bibliographic entry see Field 2I.
W79-09581

USE OF FLORIDA CYPRESS DOMES AS TERTIARY TREATMENT FACILITIES,
Florida Univ., Gainesville. Center for Wetlands.
K. Heimburg.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 166-177, (1978) 6 fig, 13 ref.

Descriptors: *Wetlands, *Tertiary treatment, *Nutrient removal, *Florida, Trees, Sewage treatment, Viruses, Economics, Public health, Water quality, Swamps.

Because the wastewater load is limited by wet seasons to something under an inch per week, it seems that this treatment alternative would be most attractive in small-scale applications such as a trailer park. In addition, small developments like this are least likely to be able to afford tertiary treatment. Cost estimates for this disposal technique show it to be competitive, even considering land and piping costs, factors not usually considered in treatment cost estimates. Long-range questions about the accumulation of nutrients in the sediments and the importance of any virus that may escape to the water table aquifer need to be answered. (See also W79-09581) (Stihler-Mass)
W79-09596

WASTEWATER TREATMENT VIA WETLAND IRRIGATION NUTRIENT DYNAMICS,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
D. L. Tilton.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 178-197, (1978) 15 fig, 2 tab, 5 ref.

Descriptors: *Wastewater, *Biological treatment, *Wetlands, *Irrigation, Nutrients, Chlorine, Phosphorus, Seasonal, Shrubs, Willow trees, Rooted aquatic plants, Marshes.

The effect of discharging approximately 10 million gallons of secondary effluent onto a ten acre section of wetland is described. Total dissolved, P, NH4 - N, NO3 + NO2 - N, and Cl were measured in the effluent and in surface waters various distances (30-255 m) from the discharge location. Total dissolved P and NO3 + NO2 - N in surface waters had returned to background concentrations within 30 m of the discharge, while Cl tended not to decrease with distance as much as the more biologically active ions. Element budgets showed the 99 percent, 95 percent and 71 percent of the total input of nitrate+nitrite-N, total dissolved P, and NH4-N, respectively, were immobilized within 30 m of the discharge site. Element immobilization occurred by a combination of physical and biological processes. (See also W79-09581) (Stihler-Mass)
W79-09597

NATURAL AND IRRIGATION HYDROLOGY OF THE PORTER RANCH PEATLAND,
Michigan Univ., Ann Arbor. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2I.
W79-09598

FRESHWATER WETLANDS: ECOLOGICAL PROCESSES AND MANAGEMENT POTENTIAL.
For primary bibliographic entry see Field 2I.
W79-09609

MANAGEMENT OF FRESHWATER WETLANDS FOR NUTRIENT ASSIMILATION,
Wisconsin Univ.-Oshkosh.
W. E. Sloey, F. L. Spangler, and C. W. Fetter, Jr.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 321-340. 2 fig, 4 tab, 57 ref.

Descriptors: *Wetlands, *Freshwater, *Nutrient removal, *Nutrients, Management, Phosphorus, Nitrogen, Denitrification, Soils, Microorganisms, Harvesting, Dikes, Hydrology, Peats, Aquatic plants, Trees, Cattails, Marshes, Tidal marshes.

Nutrient transformation processes such as sorption, coprecipitation, active uptake, nitrification and denitrification remove P and N from the free-flowing water of a wetland and transfer them to the substrate and biota for storage. Denitrification may remove up to 3.5 kg N/ha/day and as much as 20 g P/sq m may be detained in a growing season. Natural release of nutrients between growing seasons, however, either restricts application periods or demands management of wetland systems to regulate such releases. Plant harvesting removes only a few grams of P per square meter per year (<5) which is usually < 20% of that detained. Most of the remainder is in the substrate-microbial component and is subject to between-season washout. Other management techniques relate to manipulating the hydraulics of the system to optimize conditions for assimilative biochemical processes and to prevent washout from reaching surface waters. Management options for a specific wetland will depend, to a large extent, upon the particular hydrologic regime. Already, changes in the biota of some experimentally treated wetlands indicate undesirable disturbances of these valuable natural resources. Caution in the widespread use of natural wetlands to treat waste at this time is advised. (See also W79-09609) (Stihler-Mass)
W79-09630

PROCEEDINGS OF THE 1977 NATIONAL CONFERENCE ON TREATMENT AND DISPOSAL OF INDUSTRIAL WASTEWATERS AND RESIDUES, APRIL 26-28, 1977, HOUSTON, TEXAS.
1977. 329 p. Information Transfer, Inc., Rockville, Maryland.

Descriptors: *Conferences, *Industrial wastes, *Waste treatment, *Waste disposal, Regulation, Economics, Water pollution sources.

Forty-three papers were presented on the treatment and disposal of industrial waste waters and residues at this conference sponsored by the American Institute of Chemical Engineers, Gulf Coast Waste Disposal Authority, Information Transfer Inc., EPA, and the University of Houston. Topics are discussed covering a wide range of treatment and disposal methods. The effects of regulations and economic constraints are often considered. (See W79-09679 thru W79-09718) (Small-FRC)

W79-09678

PCB DISTRIBUTION IN SEWAGE WASTES AND THEIR ENVIRONMENTAL AND COMMUNITY EFFECTS,
Indiana Univ. at Bloomington.
A. K. Bergh, and R. S. Peoples.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 4-6, 1977. 2 tab, 22 ref.

Descriptors: *Polychlorinated biphenyls, *Aroclors, *Industrial wastes, *Pesticide residues, *Waste water treatment, Public health, Water pollution sources, Soil contamination, Landfills, Sludge disposal, Toxicity.

The environmental effects of PCD dumping into sewer systems are reviewed with emphasis on public health. In a Midwestern community, PCB levels of grit chamber solids were 50-530 ppm, of sludge from anaerobic digesters were 240-1700 ppm, and sewer sediment 7 miles upstream from the treatment plant were 760-950 ppm. The type of PCB present was Aroclor 1016, manufactured in St. Louis. Gardens and farms which had used dried sludge as soil conditioners were forced to remove the top soil after high levels of PCBs were determined. Fish caught 9 miles downstream from the treatment plant had PCB concentrations from 50 to over 200 ppm rendering the fish inedible. The effects of PCBs on the health of sewage plant workers and workers in a plant which used PCBs in industrial capacitors is being investigated through blood and liver tests. Sludge is being hauled to a hydrologically isolated landfill in Illinois until an alternative, economic means of disposal is determined. (See also W79-09678) (Small-FRC)
W79-09679

PROS AND CONS OF WASTE DISPOSAL ALTERNATIVES,
Weston Environmental Consultants-Designers, West Chester, PA.
For primary bibliographic entry see Field 5E.
W79-09681

EFFLUENT DISPOSAL IN A SURFACE POND LINED WITH SPENT CHARCOAL AND DIATOMACIOUS EARTH FROM BEESWAX BLEACHING PLANT,
Deutsch Engineering and Testing Services, East Meadow, NY.
I. Deutsch, and D. G. Fronmuller.
In: Proceedings of the 1977 National Conference on the Treatment and Disposal of Industrial Wastewater and Residues, April 26-28, 1977, Houston, Texas, p 19-24, 1977. 8 fig, 1 tab, 2 append.

Descriptors: *Industrial wastes, *Lagoons, *Chemical wastes, *Absorption, Filtration, Performance, Clays, Activated carbon, Diatomaceous earth, Water pollution sources, Regulation, Metals.

Disposal of manganese dioxide and potassium hydroxide residues from the bleaching of beeswax is discussed. Clay, activated carbon, and diatomacious earth are used to absorb oxidized coloring compounds. The waste water is then drained into a lagoon where waste filter cake formed a natural, almost perfect filter. Water at the water table and approximately ten feet below the water table indicated that the ground water was not affected by either the manganese dioxide or potassium hydroxide. Problems with regulatory agencies who felt that monitoring wells or different treatment methods were required, are reviewed. Experience at this plant indicates that an open pond or lagoon, properly lined with an adsorptive or absorptive or reactive material can often eliminate the need for a costly treatment facility. (See also W79-09678) (Small-FRC)
W79-09683

AN EVALUATION OF ATMOSPHERIC EVAPORATION FOR TREATING WOOD PRESERVING WASTES,
Environmental Science and Engineering, Inc., Austin, TX.
P. A. Shack, and T. D. Reynolds.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Waste Waters and Residues, April 26-28, 1977, Houston, Texas, p 29-33, 1977. 4 fig, 1 tab, 24 ref.

Descriptors: *Industrial wastes, *Oily water, *Evaporation, *Organic compounds, *Air pollution, Waste water treatment, Chemical oxygen demand, Coagulation, Settling basins, Groundwater.

The design of a forced-spray atmospheric evaporation system to treat wood preserving wastes is described. In evaporation systems, the wastewater is simply stored in shallow ponds or sprayed into the air for forced evaporation, and no discharge is produced. Design criteria for such a system are discussed including pond area, number and size of spray nozzles, prevention of excessive drift, and prevention of groundwater seepage. Laboratory tests indicated that before evaporation, coagulation is necessary to remove the oil emulsion and related apolar compounds in order to restrict hydrocarbon emissions. Coagulation with ferric chloride and lime or polymers removed 40 to 80% of the COD. Bulk oil removal and sedimentation were also necessary before spray evaporation. Thus, spray evaporation is feasible if air pollution is prevented. (See also W79-09678) (Small-FRC)
W79-09684

JOINT INCINERATION OF HIGH GREASE AND HIGH METAL SLUDGES FROM TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTES - DETROIT, MICHIGAN,
Detroit Water and Sewerage Dept., MI.
A. C. Davanzo.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 39-47, 1977. 3 fig, 2 tab.

Descriptors: *Industrial wastes, *Municipal wastes, *Oily water, *Sludge disposal, Aeration, Chlorination, Incineration, Landfills, Biochemical oxygen demand, Suspended solids, Phosphorus.

The Detroit Sewage Treatment Plant which is made up of a primary treatment plant, a secondary plant, and a solids disposal plant serving 3.1 million people, is described. Because of the predominance of metal working plants in the area, the plant receives large quantities of grease and oil. The physical/chemical primary plant has a design capacity of 1200 mgd and BOD, suspended solids, and phosphorus removal rates of 50, 65, and 55%, respectively. In the secondary plant, wastewater is subjected to aeration, clarification, and chlorination before being discharged into the Detroit River. The tons of liquid sludge generated by the plant are concentrated by vacuum filtration and incinerated in multiple hearth incinerators. The ash is trucked to landfills. This joint treatment of municipal and industrial wastes has been successful. (See also W79-09678) (Small-FRC)
W79-09685

PUTTING ACTIVATED CARBON TREATMENT IN PERSPECTIVE TO 1983 GUIDELINES,
Engineering-Science, Inc., Austin, TX.
D. L. Ford.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 48-55, 1977. 9 fig, 3 tab, 15 ref.

Descriptors: *Activated carbon, *Adsorption, *Industrial wastes, *Organic compounds, Regulation, Performance, Waste water treatment.

Activated carbon treatment of industrial waste is reviewed. Adsorption theory is rigorous for single solutes but becomes less definitive when treatment is required for waste waters containing multiple components with varying molecular weights and chemical characteristics. Many classes of organic compounds are not adsorbed effectively by carbon including oxygenated organics, and show up as residual BOD, COD, and TOC in carbon column effluents. Thus, the efficiency of activated carbon treatment is limited when treating many industrial waste waters. (See also W79-09678) (Small-FRC)
W79-09686

REDUCTIVE DEGRADATION FOR THE TREATMENT OF CHLORINATED PESTICIDE CONTAINING WASTEWATERS,
Envirogenics Systems Co., El Monte, CA.
K. H. Sweeny.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewater and Residues, April 26-28, 1977, Houston, Texas, p 56-59, 1977. 2 fig, 5 tab.

Descriptors: *Industrial wastes, *Pesticides, *Chemical degradation, *Filtration, Catalysts, Chemical reactions, Waste treatment, Pesticide residues, Costs.

The application of catalyzed reductive degradation reaction to the treatment of chlorinated toxicants and industrial pollutants, particularly pesticides, was investigated. Iron, zinc, and aluminum were generally employed as reductants, iron being preferred. The system under development consists of filtration to remove bed-clogging particulates, pH adjustment, and passage through a bed consisting of catalyzed iron powder diluted with an inert medium such as sand. A 100 gpm plant was constructed and installed for endrin-heptachlor treatment. Initial test results as low as 0.01 microgram/liter endrin and heptachlor were obtained. Treatment costs are estimated at $0.75/1000 gal. (See also W79-09678) (Small-FRC)
W79-09687

BIOLOGICAL TREATMENT OF CONCENTRATED NITRATE WASTE,
Union Carbide Corp., Tonawanda, NY. Nuclear Div.
F. E. Clark, J. M. Napier, and R. B. Bustamante.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 60-66, 1977. 7 fig, 2 tab, 11 ref.

Descriptors: *Nitrification, *Industrial wastes, *Nitrates, *Anaerobic treatment, Performance, Nuclear wastes, Biological treatment, Waste water treatment.

Bionitrification was investigated for the treatment of nitrate-rich waste at the Oak Ridge Y-12 uranium purification plant. After extensive laboratory and pilot plant development work, a full-size treatment facility is in use. It consists of two 25,000 gal, continuous flow, stirred bed anaerobic denitrification reactors. The system has reduced nitrate to nitrogen gas with feed rates up to 7.26 gm NO3 per day per liter. Start-up went well and the reactor was resistant to shocks and able to return to normal operation. The operation of the reactor was judged effective by gas flow and gas composition. There have been no problems with control, oxygen inhibition, and septic conditions. Elevated liquor temperatures may be a problem during warm weather as large amounts of heat are evolved in the process. (See also W79-09678) (Small-FRC)
W79-09688

SETTLEABILITY OF INDUSTRIAL WASTES AND THEIR ENERGY VALUES,
Los Angeles County Sanitation District, CA.
C. H. Rhee, and A. Z. Sycip.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 67-77, 1977. 9 fig, 14 tab, 7 ref.

Descriptors: *Settling velocity, *Industrial wastes, *Energy budget, *Anaerobic digestion, *Methane, Suspended solids, Waste water treatment, Chemical industry, Food processing industry, Oil industry, Pulp and paper industry.

Comparative settling characteristics and energy values of five industrial wastes were assessed. In-

dustries studied were metal plating, petroleum and refinery, chemical, food process, and paper. The removal efficiencies for suspended solids over a 75 min settling time were approximately 192 tons/day or 45% if the total solids settled. Solids discharged by the paper industry would be 125.6 tons/day or about 65.4% of the total industrial solids settled. Data are presented on the nonsettleable COD vs. settling time for each industry considered. The competitive rate of methane gas generated in the anaerobic digester from the fine industrial waste solids, was determined. The paper mill waste and food processing waste actively contributed raw materials for methane gas production. Paper mill wastes produced about 320 liters/kg vs. and food processing wastes about 1800 liters/kg vs. of gas without nutrients in a laboratory reactor. The actual anaerobic digester in a typical treatment plant produces about 1080 liters/kg vs. of gas. Technological development is needed to obtain potential benefits from methane production. (See also W79-09678) (Small-FRC)
W79-09689

TREATMENT OF INDUSTRIAL WASTES FROM AIRPORT AND AIRPLANE MAINTENANCE - A PILOT STUDY,
Consoer, Townsend, and Associates, San Jose, CA.
M. Uziel, and W. Strangio.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 78-89, 1977. 8 fig, 11 tab, 38 ref.

Descriptors: *Industrial wastes, *Airports, *Oily water, Waste water treatment, Flow control, Flocculation, Suspended solids, Trickling filter, Anaerobic treatment, Water quality.

A waste treatment process with flow equalization, oil separation, and biological oxidation was tested in a pilot plant study of airport industrial waste water treatment. The waste contained oil and grease, jet fuel, acid and alkaline materials, detergents, organic solvents, and a variety of chemical compounds. The pilot plant consisted of four units: flow and concentration equalization; flocculation of oils, grease, and suspended solids; and a trickling filter for BOD, COD, phenols, heavy metals, and detergents. For proper biological treatment, anaerobic supernant was added as a source of ammonia nitrogen. The trickling filter produced an excellent effluent which met California Regional Water Quality Control Board requirements. Also, effluent clarity and color were almost comparable to potable water. (See also W79-09678) (Small-FRC)
W79-09690

A COLOR REMOVAL PROCESS FOR A NEUTRAL SULFITE SEMI-CHEMICAL PULP WASTE,
Florida Inst. of Tech., Melbourne.
J. S. Taylor, and J. Zoltek.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 90-96, 1977. 6 fig, 2 tab, 23 ref.

Descriptors: *Color, *Pulp and paper industry, *Water properties, *Waste water treatment, *Coagulation, Magnesium, Hydrogen ion concentration, Sludge treatment, Incineration, Polymers.

A color removal process was developed on a laboratory scale for which neutral sulfite semi-chemical pulping process effluent which would meet or exceed 1983 Federal effluent standards. A three step jar test was performed for color removal by magnesium coagulation. Lime and NaOH were used for pH control. The process removed 90% of the initial color. A stoichiometric relationship was developed for magnesium and lime requirements. After color removal, a 5% hydrolyzed anionic polymer reduced the sludge volume by five fold. Color was removed from the sludge before recovery by incineration at 550C. The incinerated magnesium was recovered by carbonation, and the same magnesium was used on three separate instances to remove over 90% of the initial color from untreated waste. Ninty-three percent of the original magnesium was available for recycle after its third use. (See also W79-09678) (Small-FRC)
W79-09691

HYDROGEN PEROXIDE FOR INDUSTRIAL WASTEWATER POLLUTION CONTROL,
FMC Corp., Princeton, NJ. Industrial Chemical Div.
W. G. Strunk.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 119-125, 1977. 10 fig, 12 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Odor, *Sulfur compounds, *Oxidation, Pulp and paper industry, Oil industry, Food processing industry, Mineral industry, Chlorine, Phenols, Chemical oxygen demand, Municipal wastes.

The diverse use of hydrogen peroxide in industrial waste water treatment is reviewed. It is used to destroy sulfide odors and treat wastes when sulfur compounds such as mercaptans, thiosulfate, and sulfur dioxide are present. It destroys phenol and free available chlorine. During secondary biological treatment, hydrogen peroxide can be a source of supplemental oxygen, a control agent for filamentous sludge bulking, or a preventative for rising sludge after denitrification. About 100 municipal industrial waste water treatment plants are currently using hydrogen peroxide to solve a variety of treatment problems. Paper mills, textile plants, pharmaceutical plants, petroleum refineries, and food processing operations use hydrogen peroxide for odor control. It is also used to remove thiosulfate (COD) from a steel slag quenching reservoir, to dechlorinate industrial discharge water, and for zinc recovery from waste sludge. (See also W79-09678) (Small-FRC)
W79-09694

AMMONIA REMOVAL FROM SANITARY LANDFILL LEACHATE BY CHEMICAL/PHYSICAL BIOLOGICAL TREATMENT,
Applied Technology Associates, Philadelphia, PA.
R. L. Steiner, A. A. Fungaroli, and J. D. Keenan.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 165-175, 1977. 6 fig, 8 tab, 9 ref.

Descriptors: *Leachate, *Landfills, *Ammonia, *Nitrification, *Chlorination, Aeration, Hydrogen ion concentration, Temperature, Organic matter, Efficiencies.

The effectiveness of an ammonia removal train used in a full-scale facility to treat sanitary landfill leachate, was investigated. A 380 liter/min plant in Falls Township, Pennsylvania, treats leachate from the Geological Reclamation Operations and Waste Systems, Inc. The raw leachate is treated with lime to a pH of about 10 for the removal of heavy metals. After sedimentation, equalization and removal of ammonia are performed in an aerated lagoon. After neutralization and nutrient supplementation, activated sludge treatment oxidizes both biodegradable organics and ammonia. The clarified effluent is either chlorinated and discharged into the Delaware River or recycled to the landfill. The system removes 65-72% of the organic matter. The ammonia removal system includes ammonia stripping at alkaline pH, biological nitrification during aerobic treatment, and supplemental breakpoint chlorination. The effects of various operating variables including temperature and pH on ammonia removal efficiency was examined. Higher pH levels were necessary for equivalent removal efficiencies when the waste temperature dropped below 12.4 C. The effluent ammonia concentration is 30 mg/liter or 96%. The effluent BOD to COD ratio was 0.14. (See also W79-09678) (Small-FRC)
W79-09700

DISINFECTION OF TREATED LANDFILL LEACHATE USING SODIUM HYPOCHLORITE,
International Development and Research Centre, Ottawa (Ontario).
C. Polprasert, and D. A. Carlson.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 176-187, 1977. 10 fig, 3 tab, 32 ref, 1 append.

Descriptors: *Leachate, *Landfills, *Viruses, *Bacteria, *Activated sludge, Waste water treatment, Chlorination, Municipal wastes, Ammonia, Kinetics.

Research was conducted to determine the presence and density of bacteria and viruses in sanitary landfill leachate before and after activated sludge treatment. Chlorination characteristics were studied, and the densification efficiency for bacteria and virus removal in the treated leachates was determined. Inactivation kinetic models for survival of the microorganisms during the chlorination process were developed. The landfill studied received municipal solid wastes and anaerobically digested sludge. Landfill leachate was found to be a potential public health hazard. No viruses and few bacteria were detected in the raw leachate, but their numbers increased several fold in the aerated dilute leachates. Chlorination experiments indicated that apart from chlorine doses and contact times, ammonia levels could be a factor in organism inactivation rates. The kinetic models showed agreement with experimental data. (See also W79-09678) (Small-FRC)
W79-09701

A NON-HAZARDOUS, SIMPLE AND ECONOMICAL METHOD FOR THE DISPOSAL OF METAL SLUDGES, USING A SEGREGATED LANDFILL,
Lancy Labs., Zelienople, PA.
L. E. Lancy.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977. Houston, Texas, p 197-201, 1977. 1 fig, 2 tab, 22 ref.

Descriptors: *Landfills, *Sludge disposal, *Industrial wastes, *Leachate, Chromium, Metals, Chemical wastes, Groundwater, Water pollution sources.

Experiences with the disposal of metal sludges in segregated landfills are related, and the method is evaluated. Disposal of these sludges in sanitary landfills, accumulation in sanitary solids, and incineration all have adverse environmental impacts. The segregated landfill method is simple, economical, and safe. Tests indicate that stormwater and seepage from the sludge beds contain acceptable amounts of hexavalent chromium, soluble metals, and cyanide. The Municipal Water Quality Authority in Grand Rapids, Michigan, has operated a segregated landfill for eight years with no adverse effects on groundwater. The segregated landfill should be regulated, and sludges delivered to the site should not be contaminated with organic wastes and should be certified as to adequate treatment. Periodic testing of the leachate is recommended. (See also W79-09678) (Small-FRC)
W79-09704

WASTEWATER TREATMENT UTILIZING WATER HYACINTHS,
National Space Technology Labs., NSTL, MS.
B. C. Wolverton, and R. C. McDonald.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 205-208, 1977. 1 fig, 3 tab, 19 ref.

Descriptors: *Filtration, *Water hyacinth, *Chemical wastes, Waste water treatment, Suspended solids, Biochemical oxygen demand, Phosphorus, Nitrogen, Hydrogen ion concentration, Performance.

A water hyacinth (Eichhornia crassipes) filtration system was installed to treat 95,000 liters/day of chemical and photographic wastes. Daily waste

water and effluent samples were analyzed for pH, dissolved oxygen, total suspended solids, total organic carbon, BOD-5, phosphorus, and COD. The water hyacinths maintained an effluent pH between 6.8 and 7.8, and dissolved oxygen remained above the generally accepted standard of 5 mg/liter. Deduction in dissolved solids ranged from 29 to 75%. Kjeldahl nitrogen and total phosphorus were reduced, and BOD and COD were significantly reduced. The hyacinths successfully removed heavy metals and should be considered in developing filtration systems for the removal of trace toxic chemicals and carcinogenic organics. (See also W79-09678) (Small-FRC)
W79-09705

A NITRATE-REMOVAL ION-EXCHANGE PROCESS WITH A LAND-DISPOSABLE REGENERANT,
Houston Univ., TX.
D. A. Clifford, and W. J. Weber.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 216-225, 1977. 10 fig, 4 tab, 16 ref.

Descriptors: *Ion exchange, *Nitrates, *Industrial wastes, *Costs, *Kinetics, Separation techniques, Anion exchange, Ions, Flow rates.

An ion-exchange process for nitrate removal was studied, and its general applicability to industrial processes was examined. The single bed process and the two-bed, strong-acid, weak-base process were described, and selectivity and ion exchange column studies were performed. Results using commercially available anion exchangers exhibited drastically variable results especially with dilute multi-component solutions with ions of differing valences. Costs were reduced by operating the bed to break-through of the ion intended to be removed. Systems can be designed which yield useful land-disposable regenerants, but they are more costly. Countercurrent (upflow) regeneration may minimize the inefficient regeneration problem which is costly and necessitates the disposal of reagent chemicals. Kinetics must be considered when eluting ions not intended for removal. Premature breakthrough of the ion slated for removal can result from high service flow rates. (See also W79-09678) (Small-FRC)
W79-09707

SOLID-LIQUID WASTES FROM COAL CONVERSION PROCESSES AND CONTROL TECHNOLOGY,
Hittman Associates, Inc., Columbia, MD.
S. S. Patel, and V. B. May.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 226-232, 1977. 10 fig, 4 tab, 31 ref.

Descriptors: *Industrial wastes, *Energy conversion, *Coal, Liquid wastes, Solid wastes, Salts, Evaporation, Electrodialysis, Ultimate disposal, Leachate, Water pollution sources.

The operations and processes common to coal gasification and liquifaction plants are compared with respect to operating conditions and solid waste discharges. Waste water sources are identified, and the characteristics of the waste streams are qualitatively compared. Waste water characteristics from coke production, Synthane, and Solvent Refined Coal process are listed. Waste water treatment methods are evaluated. A combined treatment method was studied for the ultimate disposal of soluble salts from proposed coal conversion plants. When zero liquid discharge is required, pozzolanic encapsulation, with or without concentration or drying of the aqueous waste, is recommended. Evaporation before encapsulation reduces cost, and oil-fluidized evaporation or electrodialysis can be used. This is probably the best available technology for achieving ultimate disposal. (See also W79-09678) (Small-FRC)
W79-09708

THE REMOVAL OF 2,4,6-TRINITROTOLUENE (TNT) FROM AQUEOUS SOLUTION WITH SURFACTANTS,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemistry.
Y. Okamoto, E. J. Chou, J. Wang, and M. Roth.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 249-253, 1977. 5 fig, 1 tab, 21 ref.

Descriptors: *Industrial wastes, *Organic compounds, *Explosives, *Surfactants, *Separation techniques, Foam separation, Alkalis, Salts.

Treatment of waste waters from TNT manufacturing plants and loading, assembling, and packing plants, was investigated. Initial foam separation experiments demonstrated that 4-dodecyldiethylenetriamine successfully removed TNT. It was noticed that under certain conditions the surfactant formed an insoluble complex with TNT that could be removed through filtration. Investigations were made of TNT removal using fatty diamines and TNT removal using amine compounds in the presence of surfactants. Limited experimental results are presented which indicate that the anion TNT(-) initially produced in the reaction of TNT with amine, could react with unreacted TNT to form the Janovsky complex. The complex was precipitated as a salt with a protonated surfactant. (See also W79-09678) (Small-FRC)
W79-09710

DEVELOPMENT OF A REGIONAL INDUSTRIAL WASTE TREATMENT FACILITY,
Ventura Regional County Sanitation District, CA.
W. J. Bishop, R. J. Calkins, and J. Borgerding.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 282-290, 1977. 3 fig, 3 tab.

Descriptors: *Industrial wastes, *Waste treatment, *Waste disposal, *Costs, Brines, Laboratory tests, Oil wastes, Metals, California.

The development of a regional industrial waste treatment facility for Ventura County, California, is described. Projected wastes which include metallic wastes, nonmetallic toxins, brines, and oil and grease were estimated, and existing class 1 disposal sites were determined. Bench scale tests were conducted on proposed unit processes and treatment schemes for the facility. Design considerations and operational considerations are discussed. Costs are estimated at $50,4000/yr for a 5000 gpd facility and $127,500/yr for a 30,000 gpd facility. The project is currently in the design and construction stage. (See also W79-09678) (Small-FRC)
W79-09714

A VIABLE DESIGN FOR A REGIONAL INDUSTRIAL WASTE TREATMENT FACILITY,
Parsons (Ralph M.) Co., Pasadena, CA.
B. Loran.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 291-293, 1977. 1 fig, 1 ref.

Descriptors: *Industrial wastes, *Waste disposal, *Neutralization, *Incineration, *Distillation, Safety, Recycling, Treatment facilities, Waste treatment.

Current industrial waste disposal procedures were reviewed, and a design is presented of a regional industrial waste treatment facility concentrating on hazardous wastes or wastes featuring high pollutant loads. Wastes to be treated include: aqueous inorganic wastes, aqueous high BOD organic wastes, nonaqueous recyclable organic wastes, and nonaqueous nonrecyclable organic wastes. The planned treatment facility has three main sections: a physico-chemical section where most aqueous wastes are detoxified; a distillation section where many organic materials are purified for recycling; and an incineration section for the disposal of non-reusable organics. Mutual detoxification and interactive disposal are practiced for example, in co-neutralization of acidic and alkaline wastes, interactive oxidation-reduction of chromic and ferrous wastes, and co-incineration of high Btu nonreclaimable organic materials with high BOD organic wastes. Organic solvents and mineral oils are recovered by distillation and resold to aid successful financial operation. Safety aspects are considered. (See also W79-09678) (Small-FRC)
W79-09715

DYNAMIC PROGRAMMING APPROACH TO COST EFFECTIVE INDUSTRIAL WASTEWATER TREATMENT ALTERNATIVE SELECTION,
Weston (Roy F.), Inc., Richmond, VA.
K. E. Patterson.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 300-312, 1977. 3 fig, 11 tab.

Descriptors: *Waste water treatment, *Computer models, *Dynamic programming, *Optimization, Costs, Design, Treatment facilities, Regulation, Management.

A first-generation dynamic computer programming model, DYNAMO-1, can evaluate over 3000 separate waste water treatment alternatives. It can select the optimum alternative, based on present worth, for a given raw waste load in effluent limitations. The model is a serial, multi-staged decision system with each stage characterized by: an input state, an output state, a decision variable, a stage return, and a stage transformation. Input includes wastewater characterization/effluent limit, cost information, and unit process design parameters. Cost is the basis for optimization. The model can be applied to existing facilities where it develops a cost estimate based on the age of the facility, or to additional facilities where it permits optimization. (See also W79-09678) (Small-FRC)
W79-09717

FINANCIAL PLANNING OF INDUSTRIAL POLLUTION CONTROL FACILITIES,
Gannett Fleming Corddry and Carpenter, Inc., Harrisburg, PA.
T. L. Davis, and A. F. Miorin.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 313-329, 1977. 5 fig, 15 tab, 5 ref.

Descriptors: *Planning, *Financial feasibility, *Optimum development plans, *Taxes, Costs, Management, Waste water treatment.

The major elements involved in financial planning of industrial pollution control activities are discussed. Current Federal tax laws, alternative tax schemes, and state tax incentive programs are identified, and their roles in cash flow are discussed. Sources of project financing are identified, discussed, and evaluated, including commercial bank loans, tax exempt bonds, and Small Business Administration loans. Proposed project capital costs are considered, and an analysis method is presented which incorporates several common management objectives. The analysis is based on the present financial technique. This technique analyzes the cash flow patterns associated with each alternative. An example is presented which applies this financial planning process to the selection of the most cost-effective treatment and control scheme for an industry which generates sanitary and process waste waters. (See also W79-09678) (Small-FRC)
W79-09718

ROLE OF TUBIFICID WORMS ON NITROGEN TRANSFORMATIONS IN STREAM SEDIMENT,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5B.
W79-09807

5E. Ultimate Disposal Of Wastes

MANAGEMENT OF FRESHWATER WETLANDS FOR NUTRIENT ASSIMILATION,
Wisconsin Univ.-Oshkosh.
For primary bibliographic entry see Field 5D.
W79-09630

EFFECTS OF EFFLUENT DISPOSAL ON A FOREST ECOSYSTEM,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
D. A. Weinstein, and R. S. Kinerson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 922, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center University of New Hampshire, Research Report No. 22, 1979. 16 p, 2 fig, 4 tab, 11 ref. OWRT A-042-NH(1). 14-31-0001-5029.

Descriptors: Water reuse, Waste water treatment, *Waste water disposal, *Nutrients, Deciduous forests, *Waste water renovation, *Land application.

A forest system in the White Mountains of New Hampshire is evaluated as to its efficiency to renovate waste effluents. There is neither evidence of increased nutrient concentrations in plant components nor evidence of increased growth resulting from applications of nutrient rich waters. Concentrations of phosphorus increased in the litter and soil with a renovation efficiency of 20%. Renovation of other nutrients is considerably less. Recommendations are offered for consideration prior to establishment of other terrestrial waste disposal sites.
W79-09675

SAFE DISPOSAL OF PCB'S,
Amcord, Inc., Detroit, MI.
M. W. Black, and D. Usher.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 7-10. 1977, 1 tab, 8 ref.

Descriptors: *Incineration, *Polychlorinated biphenyls, *Aroclors, Environmental sanitation, Water pollution sources, Air pollution, Industrial wastes, Public health, Waste disposal.

The incineration of PCBs is discussed. Arochior 1260 was drained directly from transformers and pumped through a specially designed auxiliary burner directly into the main coal flame of a cement kiln. During incineration, the stack was sampled for PCB emission. Under these conditions, air emissions were not excessive, but more tests are recommended under different conditions with other types of incinerators. Incineration is being considered as a disposal methods because the PCBs are destroyed, unlike in landfill disposal where there are problems with leachate contamination. (See also W79-09678) (Small-FRC)
W79-09680

PROS AND CONS OF WASTE DISPOSAL ALTERNATIVES,
Weston Environmental Consultants-Designers, West Chester, PA.
A. MacGregor, and A. A. Metry.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 11-14, 1977. 1 fig, 2 tab.

Descriptors: *Waste disposal, *Waste treatment, *Industrial wastes, *Municipal wastes, Performance, Costs, Sewage treatment, Landfills, Incineration, Land use.

Waste management technologies are summarized and their applicability to general waste types are outlined. The pros and cons of each treatment method are discussed. Physical, chemical, biological, and thermal treatment methods are described, and ultimate waste disposal is discussed. Most wastes are amendable to treatment by several techniques, although hazardous wastes may be limited to one or two options. Advantages and drawbacks of various disposal methods are discussed based on relative cost, ease of operation, potential for pollution, and acceptability to the public and regulatory agencies. Conventional landfills are a cheap, available disposal method, but most industrial wastes require chemical landfills. Land application is also available for nontoxic wastes, and incineration is often the best disposal method although costs are generally high. (See also W79-09678) (Small-FRC)
W79-09681

PRACTICAL PROBLEMS IN THE OPERATION OF A HAZARDOUS WASTE DISPOSAL SITE,
Industrial Liquid Waste Disposal Co., Indianapolis, IN.
M. Crafton, and E. Kleppinger.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 15-18, 1977.

Descriptors: *Industrial wastes, *Waste disposal, *Waste pollution sources *Nickel, Ultimate disposal, Waste water treatment, Biological treatment, Scaling, Copper, Performance.

The history of the Industrial Liquid Waste Disposal Company is reviewed and practical problems encountered in the operation of a hazardous waste disposal site are discussed. Technical problems include proper operation of a biological treatment plant which must meet 99.99% removal efficiencies. Chemical treatment removes most metals but adds a high degree of TDS particularly sulfate and calcium. The high calcium levels causes scaling. There also have been problems with sufficient nickel and copper removal. There have been some public relations problems, and some problems with the NPDES permit with respect to nickel levels. Storage of waste waiting for disposal is a problem which is often faced. Methods of operation which avoid the stock piling or hazardous wastes awaiting treatment are discussed. (See also W79-09678) (Small-FRC)
W79-09682

POLYESTER ENCAPSULATION OF HAZARDOUS INDUSTRIAL WASTES,
Washington State Univ., Pullman. Dept. of Materials Science and Engineering.
R. V. Subramanian, W-P. Wu, R. Mahalingam, and M. Juloori.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 97-106, 1977. 5 fig, 3 tab, 16 ref.

Descriptors: *Waste disposal, *Chemical wastes, *Emulsions, *Safety, Dispersion, Hazards, Toxicity, Leachate, Solid wastes, Liquid wastes, Pollution abatement.

The dispersion, encapsulation, and immobilization of hazardous residuals in a polyester matrix was investigated. Most experiments were conducted with water extensible polyester Aropol WEP-661P, initiator peroxides Lupersol Delta, Superox 38, or Aposet, and synthesized or directly-obtained industrial wastes. The wastes are dispersed in the water extensible liquid polyester at high shear to form a waste-in polyester emulsion. The emulsion is solidified by adding an appropriate catalyst which can crosslink the polyester. Thus, liquid wastes are encapsulated in individual cells in a closed cell structure which makes containment of leachate easier. Mechanical integrity is retained after exposure to 500 Mrad gamma radiation. Low leachability and good mechanical properties ensure safe transportation and disposal in burial sites. The process has been successfully applied to a variety of toxic chemicals including arsenic, cyanide, PCB, poisonous metals, and pharmaceutical wastes. The process can be modified and applied to solid wastes. (See also W79-09678) (Small-FRC)
W79-09692

PILOT PLANT STUDIES ON THE POLYESTER ENCAPSULATION PROCESS FOR HAZARDOUS WASTES,
Washington State Univ., Pullman.
R. Mahalingam, M. Juloori, R. V. Subramanian, and W-P. Wu.
In: Proceedings of the National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 107-118, 1977. 12 fig, 4 tab, 10 ref.

Descriptors: *Waste disposal, *Chemical wastes, *Emulsions, *Safety, Hazards, Pilot plants, Nuclear wastes, Temperature, Flow control, Evaporation.

Hazardous wastes were encapsulated and solidified in a polyester matrix in pilot studies on simulated (radiation-free) low-level radioactive material. Both boric acid and sodium sulfate waste solutions were emulsified and solidified in proportions of up to 68% for boric acid solutions and 70% for sodium sulfate solutions. Important process parameters for successful emulsification are: water temperature, emulsion temperature, emulsification shear rate, viscosity of the emulsion, and pH. Problems which became evident during laboratory and pilot plant tests are described as they may develop in full-scale commercial operations. A minimum temperature is required to prevent the waste solution from becoming supersaturated. Evaporation of the waste at high temperatures and evaporation of the styrene present in the resin during emulsification should be prevented. Maintenance of a steady waste stream flow and the avoidance of the formation of highly viscous emulsions are necessary. These problems are not insurmountable, and the process may become valuable particularly for the disposal of nuclear power wastes. (See also W79-09678) (Small-FRC)
W79-09693

IMPACTS OF THE DISPOSAL OF HEAVY METALS IN RESIDUES ON LAND AND CROPS,
Science and Education Administration, Beltsville, MD.
J. F. Parr, E. Epstein, R. L. Chaney, and G. B. Willson.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 126-133, 1977. 2 fig, 9 tab, 18 ref.

Descriptors: *Biodegradation, *Sludge treatment, *Sludge disposal, *Crop response, *Heavy metals, Phytotoxicity, Soil contamination effects, Regulation, Public health.

An aerated pile method for composting raw and digested sewage sludges is described, and the effects of heavy metals in the composted sludge on soil and crops is discussed. Composted sludge has several advantages including low cost, the absence of odor, absence of human pathogens, and easy application of the soil conditioner. Sewage sludges can contain excess amounts of heavy metals such as cadmium which make them unsuitable for land application. The availability and phytotoxicity of heavy metals are discussed, and the USDA guidelines to limit heavy metal loadings on agricultural land are presented. Management systems can be developed to utilize composted sludges as nutrient and organic resources while minimizing possible adverse effects on soil fertility, crop quality, and public health. Sludge compost can be used in land reclamation and public works projects, for the production of trees and ornamental plants, and for landscaping. (See also W79-09678) (Small-FRC)
W79-09695

DISPOSAL AND ALTERNATE USES OF HIGH ASH PAPERMILL SLUDGE,
Ayres (Owen) and Associates Inc., Eau Claire, WI.
J. S. Perry, and D. I. Schultz.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 134-146, 1977. 15 fig, 9 tab, 11 ref.

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Descriptors: *Pulp and paper industry, *Sludge disposal, *Landfills, *Design criteria, Environmental engineering, Permeability, Clays, Drying, Leachate.

Application data and design criteria are presented for landfill disposal and alternate uses of high ash papermill sludge. Landfill site location criteria include sufficient, low-permeability soil; proper zoning; at least 1/4 mile from the nearest downgradient water supply; and reasonable proximity to plant. The sludge is composed of small amounts of chemical impurities, Kaolin clay, and paper fiber. The physical properties of the dry sludge solids include 54% ash content, 46% organic content, a minimum density of 68 lbs/cu ft, a solids specific gravity of 1.85 + or - .01, and a moisture content of 270-300% dry solids. Sludge mechanical properties were determined and generally indicated good engineering behavior. Porewater and leachate composition were determined. The disposal site was designed considering site operation, trafficability, and settlement. Possible alternatives to landfill disposal are mentioned including utilization of the sludge as an impervious cap material, construction of farm pond and lagoon liners of the sludge, and light weight fill applications. (See also W79-09678) (Small-FRC)
W79-09696

ENVIRONMENTAL ASSESSMENT OF THE DISPOSAL OF INDUSTRIAL WASTEWATER RESIDUALS IN A SANITARY LANDFILL,
Environmental Enterprises Incorporated, Cincinnati, OH.
D. J. McCabe.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 146-150, 1977. 3 tab, 5 ref.

Descriptors: *Sludge disposal, *Chemical wastes, *Industrial wastes, *Landfills, Settling lagoons, Metals, Organic compounds, Leachate, Toxicity, Controlled drainage, Ultimate disposal.

Two proposed cases of disposal of chemical industrial waste water residues in landfills were investigated. Both sludges were accumulated in lagoons for several years. Multiple core samples were taken from several sections of the lagoons and the residuals were subjected to detailed chemical analysis. Sludges contained, among others, Cd, Cr, Cu, Pb, Ni, Hg, and cyanide. The organics and metallics that would be leached were characterized by leaching tests which considered these parameters: alkalinity, chlorinated hydrocarbons, alcohol, aldehydes, esters, acids, and carbon. Non-activated sludge bacteria were used in toxicity tests. The impact of this disposal method on groundwater quality was assessed. Leachate may contain unacceptable levels of Cd, Cu, Zn, and PB; thus, an underground drainage system is planned for the landfill. Finally, an operational plan was developed indicating how removal, transport, and disposal operations would occur. (See also W79-09678) (Small-FRC)
W79-09697

LAND DISPOSAL OF ACIDIC BASIC AND SALTY WASTES FROM INDUSTRIES,
North Carolina State Univ. at Raleigh.
D. Pal, M. R. Overcash, and P. W. Westerman.
In: Proceedings of the 1977 National Conference on the Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 151-159, 1977. 4 fig, 6 tab, 16 ref.

Descriptors: *Industrial wastes, *Agricultural engineering, *Soil contamination, *Crop response, Acidity, Alkalinity, Salts, Sodium compounds, Water pollution sources, Water quality.

Research on the land application of industrial wastes was conducted as part of a project to develop a computer program to model industrial waste constituents. Three constituents- acid, base, and salts- were investigated considering soil characteristics, waste characteristics, crop tolerance level, climatologic and geologic variables, and management and economic factors. For optimum results, acidic wastes should be applied to alkaline soil and basic waters to acid soil. Salty wastes should be applied to base unsaturated acid and non-saline sodic soils. The sodium adsorption ratio should be adjusted by the addition of Ca or Mg to below 10 to eliminate excessive Na accumulation on exchange sites. The loading rate of necessary amendment for soil and waste combined can be determined from the cation exchange capacity, exchangeable cation percentage, and percent base saturation of the soil system. Waste waters are not appropriate for continuous land application when EC is greater than 2000 micro mnos/cm at 25 C unless salts are removed or water is available to wash accumulating salts from the soil. The effects of waste disposal on groundwater quality must be considered. (See also W79-09678) (Small-FRC)
W79-09698

THE COMBINATION OF FLUE-GAS DESULFURIZATION SLUDGES AND MUNICIPAL WASTE TO PRODUCE FERTILE SOILS,
Dravo Lime Co., Pittsburgh, PA.
R. W. Briggs, R. C. Freas, and L. Pasztor.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 160-164, 1977. 3 fig, 4 tab, 3 ref.

Descriptors: *Sludge disposal, *Municipal wastes, *Soil analysis, *Soil physical properties, Crop response, Permeability, Bulk density, Leachate, Water pollution sources.

The first phase of a project to determine the optimum conditions under which fuel gas desulfurization sludges could be stabilized and combined with municipal sludges to produce fertile soil, is reported. Bench scale stabilization testing of the sludge mixtures, and indoor plant growth tests were performed. The mixture could be stabilized and did support vegetation; several mixtures developed had physical properties acceptable for fertile soil. Four of the 65 synthetic soil samples had a bulk density of 1.2 gm/cc which is close to the optimum 1.3 gm/cc. Permeability levels were low and approached the minimum acceptable standard of 0.1 in/hr. Leachate tests indicated that the Cu, Fe, Zn, and Mn are below secondary maximum contaminant levels for public water systems. Because the flue gas desulfurization sludges were generated in an alkaline system, pH values and sulfate ion concentrations were relatively high. Phase 2 of the study will be comprised of field tests. (See also W79-09678) (Small-FRC)
W79-09699

DISINFECTION OF TREATED LANDFILL LEACHATE USING SODIUM HYPOCHLORITE,
International Development and Research Centre, Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W79-09701

LAND CULTIVATION OF INDUSTRIAL WASTEWATERS AND SLUDGES,
SCS Engineers, Inc., Long Beach, CA.
H. T. Phung, D. E. Ross, and R. E. Landreth.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 191-196, 1977. 3 tab, 20 ref.

Descriptors: *Industrial wastes, *Waste disposal, *Agricultural engineering, Waste water treatment, Soil contamination, Crop response, Salts, Organic compounds, Heavy metals.

Land cultivation of industrial waste waters and sludges is practiced currently by only a few industries on a limited scale in the US. The method is viable only where soil, climate, waste characteristics, and environmental conditions permit, and can be an agricultural project or only waste disposal. Preliminary results from field tests on the cultivation of oily sludges found increased soluble salt and organic carbon contents in soils and accumulation of heavy metals in soils and plants. Few environmental monitoring programs are being conducted at land cultivation sites. (See also W79-09675) (Small-FRC)
W79-09703

SOLID-LIQUID WASTES FROM COAL CONVERSION PROCESSES AND CONTROL TECHNOLOGY,
Hittman Associates, Inc., Columbia, MD.
For primary bibliographic entry see Field 5D.
W79-09708

LEACHING STUDIES AND CATION EXCHANGE PROPERTIES OF COAL FLY ASH,
Fredonia Wastewater Treatment Plant, NY.
J. F. Gaasch, and K. S. Law.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 245-248, 1977. 4 fig, 4 tab, 11 ref.

Descriptors: *Fly ash, *Solid wastes, *Leachate, *Ion exchange, Waste disposal, Water pollution sources, Solubility, Hydrogen ion concentration.

The leaching and ion exchange properties of fly ash were investigated as part of a project to assess the environmental impact of a fly ash disposal site. When fly ash is exposed to water it releases soluble material which either precipitates or is reabsorbed via ion exchange into the insoluble glass matrix of the ash. Soluble material loss is minimized at low pH. The exchange capacity of fly ash is significant when compared to the concentration of heavy metals initially solubilized, but is small when compared to that of ion exchange resins. When ion affinities for polyvalent ions other than chrome and zinc are also high, fly ash may age so as to minimize toxic leachate. (See also W79-09678) (Small-FRC)
W79-09709

AN INDUSTRIAL RESIDUE MANAGEMENT SYSTEM FOR ALLEGHENY COUNTY, PENNSYLVANIA- PART II,
Environmental Quality Systems, Inc., Rockville, MD.
E. J. Martin, and D. Berman.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 265-275, 1977. 11 tab, 28 ref.

Descriptors: *Industrial wastes, *Waste disposal, *Waste treatment, *Landfills, *Information exchange, Fly ash, Water pollution sources, Ultimate disposal.

Treatment and disposal alternatives are discussed as part of a study of the generation rates and treatment and disposal alternatives of industrial residues in the Pittsburgh area. Waste exchanges, which have been established in over 10 European countries and the U.S. are described, including centralized facilities and area-wide systems. Here waste users and waste producers can correspond. Also, scientific landfills and sanitary landfills are described. Treatment alternatives are presented for scrubber sludges, flue gas desulfurization sludges, air pollution dust, steel slag, foundry sand and metallic dust, mill scale, cement dust, cullet-glass production, and fly ash. (See also W79-09678) (Small-FRC)
W79-09712

THE GENERATION AND DISPOSAL OF HAZARDOUS WASTES IN MASSACHUSETTS,
GCA Corp., Bedford, MA.
P. F. Fennelly, M. A. Chillingworth, P. D. Spawn, M. I. Bornstein, and H. I. Bonne.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 276-281, 1977. 2 fig, 5 tab.

Descriptors: *Legislation, *Regulation, *Massachusetts, *Hazards, *Waste disposal, Organic compounds, Solvents, Liquid wastes, Solid wastes, Oil wastes, Water pollution sources.

Group 5E—Ultimate Disposal Of Wastes

The current hazardous waste regulatory program in Massachusetts is reviewed, and a hazardous waste inventory is described. Legislation passed in 1970 established a Hazardous Waste Board, and regulations have been established regulating acceptable disposal methods for: hydrocarbon liquids, aqueous liquids, solids and sludges, and special hazards. A survey was performed to estimate the quantities of hazardous waste, identify disposal and recycling options, and to recommend disposal options. The following wastes were identified: 18,313,000 gal/yr waste oil, 2,784,000 gal/yr solvents, 2,293,000 aqueous liquids, 13,928,000 solids and sludges, and 756,000 other. (See also W79-09678) (Small-FRC)
W79-09713

EFFECT OF A TROPICAL SWAMP ON WATER QUALITY,
Nairobi Univ. (Kenya). Dept. of Botany.
For primary bibliographic entry see Field 5A.
W79-09775

5F. Water Treatment and Quality Alteration

COLD CLIMATE UTILITIES DELIVERY DESIGN MANUAL,
Alberta Univ., Edmonton.
D. W. Smith, S. Reed, J. J. Cameron, G. W. Heinke, and F. James.
Environment Canada, Economic and Technical Review Report No. EPS 3-WP-79-2, March 1979. 698 p, 202 fig, 77 tab, 283 ref, 8 append.

Descriptors: *Canada, *Utilities, *Cold regions, *Cold weather construction, Water supply, Waste water treatment, Plumbing, Sludge disposal, Pipes, Waste disposal, Sewage disposal, Waste water disposal, Solid wastes, Freezing, Arctic, Alaska, Municipal wastes, Municipal water, Permafrost.

The special problems of providing utility services in 'cold climate' areas such as Alaska, the Yukon, and the Northwest Territories are discussed. Among the factors causing special problems to the development of services in northern communities are: permafrost, climate, remoteness, lack of planning for services, inadequate housing, and often lack of an economic base. All traditional sources of water are present in most parts of cold regions but conditions such as shallow or frozen lakes, high mineral concentrations in unfrozen water, high organic content of runoff, low precipitation, and high river silt content make special considerations necessary. Wells are expensive due to thermal protection requirements and well water may be highly mineralized. The dominant characteristics of cold regions utility systems is the need to prevent both the water and sewage lines from freezing. Trucked delivery of water and pickup of sewage is an alternate means of providing service. Human feces are often disposed of without any treatment in a dump together with solid wastes. Other forms of disposal, such as incineration, shredding, or baling have found limited application due to high maintenance and operational costs. Fire protection is also a serious problem in cold climate areas due to the lack of adequate water supplies, the extreme dryness of wood and organic materials, and the dependence on heating systems for survival. (Seigler-IPA)
W79-09671

COMPARATIVE ALGICIDE EVALUATIONS USING LABORATORY AND FIELD ALGAE,
Florida International Univ., Miami. Drinking Water Quality Research Center.
For primary bibliographic entry see Field 5A.
W79-09786

5G. Water Quality Control

TIMBER HARVESTING PRACTICES AND WATER QUALITY IN THE EASTERN UNITED STATES,
Northeastern Forest Experiment Station, Pennington, NJ.
For primary bibliographic entry see Field 4D.
W79-09590

EFFECTS OF FEEDING RATE ON WATER QUALITY, PRODUCTION OF CHANNEL CATFISH, AND ECONOMIC RETURNS,
Auburn Univ., AL.
L. Tucker, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 970, Price codes: A03 in paper copy, A01 in microfiche. Master of Science, Thesis, March 1979. 34 p, 5 fig, 8 tab. OWRT B-076-ALA(1).

Descriptors: *Channel catfish, *Feeding rates, Dissolved oxygen, Fish mortality.

Channel catfish (Ictalurus punctatus) were stocked in static ponds without aeration at three rates (4,942, 10,007, and 20,385 per hectare) and fed six days weekly. Each treatment was replicated six times. Maximum feeding rates of 33.6, 56, and 78.4 kg/ha, respectively, were reached by mid-summer. In the low treatment, no dissolved oxygen (DO) problems occurred, and survival was 99.1%. In the medium treatment, DO at dawn frequently fell below 2.0 mg/liter and some fish suffocated during an oxygen depletion in one pond. However, survival averaged 92.7%. In the high treatment, DO at dawn was usually below 2 mg/liter in August and September. Fish mortalities resulted from DO depletion in three ponds of the high treatment, but survival averaged 82.6%. Nitrite nitrogen and unionized ammonia never reached concentrations recognized to be lethal to channel catfish in any of the treatments. However, concentrations of unionized ammonia were possibly high enough to have adversely affected growth. Net production of fish increased from low to high treatment, even though the average weight of individual fish decreased. The low treatment produced an average of 2,992.8 kg/ha of fish and a net gain of $1,265.38. The medium treatment produced an average of 4,096.7 kg/ha and a net gain of $2,181.59. The high treatment produced an average of 4,857.8 kg/ha and a net gain of $1,680.18.
W79-09722

EFFECT OF SELECTED GEOLOGY-SOIL COMPLEXES ON WATER QUALITY OF THE LITTLE BLACK FORK CREEK,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
S. L. Ponce, K. D. Sundeen, and W. Striffler.
Completion Report for U.S. Forest Service, Northeastern Forest Experiment Station. Res. Work Unit FS-NE-1602, 1979, 96 p. 20 fig, 16 tab, 20 ref.

Descriptors: *Acids, Alkalinity, Analytical techniques, Calcium, Geochemistry, Magnesium, Mountain forests, *Small watersheds, Soil types, Water chemistry, Appalachian Mountains, Cluster analysis, West Virginia.

This study interprets the chemical water quality of an undisturbed Appalachian watershed in relation the soil and geologic complexes exposed and develops a method for the prediction of baseline stream chemistry as a function of soil and geologic complexes. Water quality data were collected and analyzed over a two and one-half year period for almost 50 sites within a 1230 ha undisturbed basin in northeastern West Virginia. Six soil and geologic complexes were exposed on the watershed. Cluster analysis was applied to the data set to group sites with similar water quality. The stream chemistry of each group of similar sites was then related to the soil and rock complexes exposed. Streams draining sandstone were more acid and less fertile than streams draining limestone. Specific conductance and pH were selected as the most important parameters to simulate. Prediction techniques were initially based on mass-balance concepts. However, missing discharge values were synthesized and water quality rating curves developed for both specific conductance and pH. The functions developed are only first approximations and require further refinement and development. (Forest Service)
W79-09800

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE IMPACT OF THE COLUMBIA GENERATING STATION ON THE SURFACE AND GROUNDWATER HYDROLOGY OF A RIVER FLOODPLAIN WETLAND,
Wisconsin Univ.-Madison. Dept. of Geology.
For primary bibliographic entry see Field 2I.
W79-09586

ESTIMATING WETLAND WATER LEVELS,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
R. E. Terrell, O. L. Loucks, and C. B. Andrews.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 77-82. (1978) 3 fig, 3 ref.

Descriptors: *Water levels, *Wetlands, *Systems analysis, *Mathematical models, Wisconsin, Groundwater, Surface water, Inflow, Discharge.

To be able to model wetland water levels, one needs adequate information about water inflows to and outflows from the wetland. The response curve of the wetland to changes in either inflows or outflows must also be determined. In all but the simplest situations, the curve would have to be determined empirically. Groundwater inflow and surface water outflow were the major determinants of surface water levels in a sedge meadow examined by the authors. (See also W79-09581) (Stihler-Mass)
W79-09587

WETLANDS FORMATION: SPATIAL MODELING OF LAKE-EDGE WETLANDS DEVELOPMENT,
Wisconsin Univ.-Madison. Inst. for Environmental Studies.
R. M. Friedman, and C. B. DeWitt.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 232-241, (1978) 3 fig, 10 ref.

Descriptors: *Lakes, *Shores, *Wetlands, *Simulation analysis, *Ecosystems, Energy, Mathematical models, Nutrients.

The formation of lake-edge wetlands from their glacial origins to the present has been described using a set of spatial, ecosystem-level models. Innovations in spatial modeling techniques, combined with a focus on ecosystem-level attributes of wetlands, allow a conceptual model of the wetlands development process to be expressed mathematically and tested with data derived from peat sediments. (See also W79-09581) (Stihler-Mass)
W79-09599

THE USE OF MODELS TO STUDY WETLAND REGULATION OF NUTRIENT LOADING TO LAKE MENDOTA,
Wisconsin Univ.-Madison. Dept. of Botany.
O. L. Loucks, and V. Watson.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 242-252, 1978, 2 fig, 6 tab, 11 ref.

Descriptors: *Wetlands, *Nutrients, *Simulation analysis, *Lakes, Hydrology, Seasonal, Nitrogen, Phosphorus, Algae, Bluegreen algae, Wisconsin, Lake Mendota(WI).

The combination of a precarious N:P ratio in the epilimnetic system of Lake Mendota in summer and the increased phosphorus loadings in summer through wetland drainage provide a basis for believing that the wetland drainage programs in the

Lake Mendota basin can have had a significant influence on the present lake. This change will have been through the reduction of the N:P ratio in the epilimnion to the point where blue-green algae are given an advantage over other algal forms that lead to a healthy productive food chain. (See also W79-09581) (Stihler-Mass)
W79-09600

CONCEPTUAL MODELING OF COASTAL WETLANDS IN SOUTHWESTERN LOUISIANA AND SOUTHEASTERN TEXAS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 6G.
W79-09601

OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIO-ECONOMIC IMPACT ASSESSMENT,
New Orleans Univ., LA. Urban Studies Inst.
A. J. Mumphrey, Jr., R. E. Thayer, F. W. Wagner, J. S. Brooks, and C. B. Fromherz.
August, 1977. 272 p, 16 fig, 61 tab, 51 ref.

Descriptors: *Louisiana, *Continental shelf, *Planning, *Coasts, Wetlands, Developed waters, Social aspects, Economics, Management, Costs, Evaluation.

In the seven chapters which comprise this study, various impacts of out-continental shelf (OCS) oil and gas development on the Louisiana coastal zone and related topics are discussed. Chapter 2 deals with the OCS related production, employment, and population impacts. In Chapter 3 the public service sectors are analyzed. Chapter 4 analyzes local needs, expenditures, and fiscal capabilities. Chapter 5 presents the stages of development and the basic problems associated with development in this environment. It also identifies additional costs incurred in both initial wetlands development and continued maintenance of the developed areas. Chapter 6 assesses the effectiveness of the planning and management capability of the local governments. Chapter 7 provides a discussion of citizen participation at both the theoretical level and the practical level through an examination of the Louisiana Coastal Resources Program's Public Participation Program. (Steiner-Mass)
W79-09635

URBAN DEVELOPMENT IN THE LOUISIANA COASTAL ZONE: PROBLEMS AND GUIDELINES,
New Orleans Univ., LA. Urban Studies Inst.
A. J. Mumphrey, Jr., J. S. Brooks, and J. C. Miller, Jr.
December, 1976. 142 p, 7 fig, 5 tab.

Descriptors: *Louisiana, *Wetlands, *Community development, Marsh management, Conservation, Urbanization, City planning, Planning, Management, Legislation, Coastal marshes, Regulation, Coasts.

This study seeks to examine all steps in the urban development process as it impacts wetlands and to identify resulting problems and propose guidelines which mitigate them. Chapter 1 reviews existing coastal zone ordinances, regulations, and codes at the parish level. An attempt is made to show to what degree, if any, special wetland characteristics have been considered in these ordinances. This chapter also examines restrictive mechanisms placed on wetlands development by the National Flood Insurance Program and the U.S. Army Corps of Engineers permitting process. A problem identification methodology is used in Chapter 2 to examine the urban development process as it occurs in the coastal zone. Moving through each of the stages of wetlands development in sequence, this methodology is used to identify potential development problems and their results. For those development practices determined to be not or inadequately regulated, development guidelines are recommended in Chapter 3. Chapter 4 concludes the study with a brief discussion of a process for developing future urban development regulations in the coastal zone. (Steiner-Mass)
W79-09637

MODELING THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PRODUCTION PONDS,
Auburn Univ., AL.
For primary bibliographic entry see Field 4A.
W79-09721

WATER MANAGEMENT MODEL FOR FRONT RANGE RIVER BASINS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, and J. M. Shafer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 950, Price codes: A06 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute. Colorado State University Technical Report No. 16, April 1979. 91 p, 31 fig, 15 tab, 22 ref. OWRT A-039-COLO(2). 14-34-0001-8006.

Descriptors: *Model studies, *Planning, Water supply, Water reuse, Colorado River Basins, Rawhide Power Plant.

This report describes the development of a simulation model for water planning or management in a Front Range river basin or sub-basin. The application of the model is illustrated by two cases. Cooling water demands for the Rawhide Power Plant in Larimer County are proposed to be met with reusable foreign water from Fort Collins' sewer effluent. The model examines all options in reservoir storage and stream and river exchanges and selected options in reservoir storage and stream and river exchanges and selects the optimum combination. Vested water rights are always protected. The second case is management of water releases from storage in high mountain reservoirs in such a way that vested water rights remain undisturbed, while at the same time instream flow demands are more nearly met. With the new tool, options can be examined by any water owner who may desire to meet a new pattern of water use--irrigation, municipal, industrial, or a combination of two or more of these together in sequential use programs.
W79-09723

SIMULATION ANALYSIS OF THE UNCONFINED AQUIFER, RAFT RIVER GEOTHERMAL AREA, IDAHO-UTAH,
Geological Survey, Carson City, NV. Water Resources Div.
W. D. Nichols.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.90. Geological Survey Water-Supply Paper 2060, 1979. 46 p, 13 fig, 7 tab, 14 ref.

Descriptors: *Hydrogeology, *Groundwater movement, *Computer models, *Hydrologic properties, *Aquifers, Simulation analysis, Hydrologic budget, Hydrodynamics, Semiarid climates, Water table, Pumping, Water levels, Groundwater recharge, Transmissivity, *Raft formation(Idaho).

This study covers about 1,000 sq mi of the southern Raft River drainage basin in southcentral Idaho and northwest Utah. The main area of interest, approximately 200 sq mi of semiarid agricultural and range land in the southern Raft River Valley that includes the known geothermal resource area near Bridge, Idaho, was modelled numerically to evaluate the hydrodynamics of the unconfined aquifer. Computed and estimated transmissivity values range from 1,200 sq ft/d to 73,500 sq ft/d. Water budgets, including ground-water recharge and discharge for approximate equilibrium conditions, have been computed by several previous investigators; their estimates of available ground-water recharge range from about 46,000 acre-ft/yr to 100,000 acre-ft/yr. Simulation modeling of equilibrium conditions represented by 1952 water levels suggests: (1) recharge to the water-table aquifer is on the order of 63,000 acre-ft/yr; (2) a significant volume of ground water is discharged through evapotranspiration by phreatophytes growing on the valley bottomlands; (3) the major source of recharge may be from upward leakage of water from a deeper, confined reservoir; and (4) the aquifer transmissivity probably does not exceed about 12,000 sq ft/d. Additional analysis carried out by simulating transient conditions from 1952 to 1965 strongly suggests that aquifer transmissivity does not exceed about 7,700 sq ft/d. The model was calibrated using slightly modified published pumpage data; it satisfactorily reproduced the historic water-level decline over the period 1952-65. (Woodard-USGS)
W79-09739

6B. Evaluation Process

A COMPARATIVE STUDY OF THE SANDHILL CRANE SUBSPECIES,
Wisconsin Univ.-Madison. Dept. of Zoology.
J. H. Baldwin.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 266-275, 1978, 8 fig, 1 tab, 13 ref.

Descriptors: *Birds, *Migratory birds, *Geographical regions, Wetlands, Water birds, Physiology, Canada, Alaska, Wisconsin, Idaho, Florida, Sandhill cranes.

This study defines and compares the variation in the anatomy, physiology and development of four of the six sandhill crane subspecies: Grus canadensis canadensis, G. c. rowani, G. c. tabida and G. c. pratensis. Generally speaking, the rate of development increased with increasing latitude of the breeding grounds. Appendages, except for wings, were shorter at higher latitudes; overall body size decreased with increasing latitudes. Down length of nestlings varied directly with latitude of the breeding grounds. The three wetland subspecies (rowani, tabida and pratensis) exhibited faster rates for height, tarsus, culmen and midtoe growth than canadensis which prefers drier habitats. Subspecific variations defined in this study lend evidence that each subspecies is a unique genetic unit. (See also W79-09581) (Stihler-Mass)
W79-09602

LAKESHORE PHYSIOGRAPHY AND USE,
For primary bibliographic entry see Field 2H.
W79-09653

A COMPARISON OF STUDY YEAR DATA OF DIVISIONAL OUTDOOR RECREATIONAL USE ON THE LOWER COLORADO RIVER, 1974-1978,
Arizona State Univ., Temple. Dept. of Leisure Studies.
G. W. Greey, G. W. Cheatham, A. C. Jaten, and R. J. Virden.
Prepared for the Bureau of Reclamation, May 1979. 414 p, 15 fig, 331 tab. 14-06-300-2532.

Descriptors: *Colorado River, *Recreation, *Recreation facilities, Camping, Boating, Swimming, Camp sites, Land use, Reasonable use, Tourism, Use rates, Hunting.

User participation data for selected sites on the Lower Colorado River (LCR) between Davis Dam and San Luis are presented and compared with data from eleven previous studies. Random observations of 268 sites were systematically conducted. For each of the ten divisions of the LCR, the following is provided: a description of the physical and geographic characteristics, a delineation of any interim variation occurring between study years, a discussion of special considerations unique to the division, and a listing of the sites observed. The comparison data show significant yearly increases in visitors, recreation units, and recreation participation throughout the LCR during the period studied. Major increases were: (1) the number of visitor use days increased 15% yearly, (2) the number of recreational units observed within all divisions increased 18.6% yearly, and (3) visitor participation in recreational activities increased 22.4% yearly. The rankings of visitor activity preferences remained nearly the same except for the increased popularity of picnicking.

It is anticipated that the trend toward increased usage will continue causing increasing user impacts on the LCR. (Seigler-IPA)
W79-09663

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIO-ECONOMIC IMPACT ASSESSMENT,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 6A.
W79-09635

6E. Water Law and Institutions

WETLANDS ARE CONSTITUTIONALLY PROTECTED,
Wisconsin's Environmental Decade, Madison.
K. M. Falk.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 121-128, (1978).

Descriptors: *Wetlands, *Protection, *Legal aspects, *Wisconsin, Legislation, Constitutional law.

Not only does the proposed wetland bill (Wisconsin) lack sufficient expressed limitations on the delegation, but the language of the proposed statute does not retain any residue of state control to review and approve a variance before it is granted. This kind of unlimited local authority allows policy determinations in areas of state-wide concern to be made without prior review and approval by some state agency. At some point, the variance power should be reviewed by state authority before it becomes operative in order for delegation to withstand constitutional attack. (See also W79-09581) (Stihler-Mass)
W79-09592

ECOLOGY AND THE REGULATION OF FRESHWATER WETLANDS,
WAPORA, Inc., Washington, DC.
J. McCormick.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 341-355. 9 ref, 1 append.

Descriptors: *Wetlands, *Freshwater, *Legislation, Communication, Regulation, Administration, Ecology, Legal aspects, Planning, Protection, Management, Rivers and Harbors Act.

The protection of our shrinking wetland resources has been bolstered in recent years with the enactment of several federal laws including the National Environmental Policy Act of 1969, the Federal Water Pollution Control Act of 1972, the Coastal Zone Management Act of 1972 and the Endangered Species Act of 1973. These laws together with the still powerful River and Harbor Act of 1899, several administrative directives and recently enacted state laws form the basis for the informed management of out wetlands. So that management decisions are truly based on 'the best available data,' scientists have a special responsibility to communicate their knowledge of wetlands in ways intelligible to decision makers who are most often laymen. The present state of wetland regulation is primitive, being derived more from common sense than from science. Future wetland regulation to be fully effective and rational must be conducted in conformity with the ecologically based, long-range planning with the focus on the wetland system as a dynamic resource. To achieve this goal, it is imperative that wetland ecologists, consultants, planners and regulators work toward standardization of methodology for obtaining, presenting and evaluating data thus permitting more direct comparison of data and reduction of variation in data produced by different groups. (See also W79-09609) (Stihler-Mass)
W79-09631

LOUISIANA PARISH BOUNDARIES THROUGH LAKES, BAYS, AND SOUNDS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
M. B. Newton, Jr., and E. St. C. Easterley, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 620, Price codes: A07 in paper copy, A01 in microfiche. Sea Grant Publication No. LSU-7-77-002, Louisiana Sea Grant Program. June, 1977. 128 p, 21 fig, 5 tab, 18 ref.

Descriptors: *Louisiana, *Boundaries(Property), Legal aspects, Lakes, Bays, Negotiations, Judicial decisions, Application methods.

Divided into three main parts, this report attempts to clarify the processes through which parish boundaries through lakes, bays, and sounds are established. Part one describes the principles, both legal and academic, pertaining to the drawing of boundaries. Part two describes a negotiation schedule to be used between parishes in the settlement of boundary lines without litigation. Part three presents several case histories of earlier attempts at boundary settlement. (Steiner-Mass)
W79-09636

URBAN DEVELOPMENT IN THE LOUISIANA COASTAL ZONE: PROBLEMS AND GUIDELINES,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 6A.
W79-09637

A GUIDE TO THE COASTAL WETLANDS REGULATIONS OF THE MASSACHUSETTS WETLAND PROTECTION ACT (G.L. 131, S. 40).
Massachusetts Dept. of Environmental Quality Engineering, Boston. Div. of Wetlands.
1978. 158 p.

Descriptors: *Wetlands, *Legal aspects, *Massachusetts, *Permits, *Regulation, Legislation, Atlantic Coastal Plain, Shores, Beaches, Dunes, Marshes, Dredging, Groins(Structures), Piers.

This guide has been designed as a working reference document and tool. It explains how to prepare/review an application for a 'wetland permit' under the Wetlands Protection Act. The 11 resource areas identified in the Regulations which are to be protected in the coastal zone are defined and explained. Fifteen common activities which are to be regulated under the general terms stated in the Act as 'dredging, filling, removal and altering' are defined and the adverse impacts of such activities described. Regulation Section 24 is also discussed. A glossary and list of sources of maps and aerial photographs are provided. (Stihler-Mass)
W79-09640

MUNICIPAL WASTEWATER TREATMENT WORKS CONSTRUCTION GRANTS PROGRAM: PROGRAM REQUIREMENTS MEMORANDA.
Environmental Protection Agency, Washington, DC. Office of Water Program Operations.
Report No. MCD-02.8, June 1979. 28 p.

Descriptors: *Municipal wastes, *Waste water disposal, *Sewage disposal, *Construction costs, Environmental effects, Underground waste disposal, Cost analysis, Septic tanks, Environmental sanitation, Management, Waste water treatment, Sewage treatment.

Three memoranda to regional water division directors are presented. The first, grant funding of projects requiring treatment more stringent than secondary, outlines Environmental Protection Agency (EPA) policy and procedures concerning these projects. The projects are grouped into two categories, advanced secondary treatment (AST) and advanced waste treatment (AWT). The memorandum also provides a standard for reviewing the financial impact of advanced projects upon small communities. The second memorandum, small wastewater systems, clarifies EPA policy on the funding of privately and publically owned small alternative wastewater systems, provides guidelines for identifying expensive projects, and implements the new Federal interagency agreement for rural wastewater projects. Small alternative wastewater systems are wastewater conveyance and/or treatment systems other than conventional systems and include septic tanks and subsurface disposal systems, other on-site systems including dual systems, small systems serving clusters of small users, and six-inch or smaller gravity sewers. The third memorandum sets forth the policy on outlay management in the construction grant program to develop more accurate fiscal estimates for the President's budget and to initiate a comprehensive program of project management. (Seigler-IPA)
W79-09669

THE NAVIGATION SERVITUDE AND RESERVED INDIAN PROPERTY: DOES THE RULE OF NO COMPENSATION APPLY TO INDIAN INTERESTS IN NAVIGABLE WATERS,
District Court (U.S.), Portland, OR.
R. Ericsson.
Utah Law Review, Vol. 57, No. 1, p 57-76, 1979.

Descriptors: *Navigable waters, *Indian reservations, *Eminent domain, Federal government, Navigable rivers, Federal reservations, Water law, Constitutional law, Compensation, Property values.

When the federal government, pursuant to its power over navigation, destroys oyster beds, floods land, controls water power, or does other activities affecting property interests below the high-water mark of navigable water, normally no liability arises. The legal justification is that property interests have always been subject ot a navigation servitude. While this rule is firmly established as to state and individual property, its applicability to Indian tribal property is a point of controversy. The issues involved in this controversy are illustrated by: (1) a review of the publics' paramount interest in navigable waters which led to the present rule of no compensation; (2) an examination of the principles of Indian treaty interpretation and property law; and (3) an interface of these two bodies of law. A review of the case law indicates that federal courts will read implied property rights into Indian treaties. In interpreting treaties, courts will construe the language in favor of the Indians' understanding of it. The presumption against compensation will remain unless rebutted by the government's making those interests compensable. (Vloedman-Florida)
W79-09830

6F. Nonstructural Alternatives

OCS DEVELOPMENT IN COASTAL LOUISIANA: A SOCIO-ECONOMIC IMPACT ASSESSMENT,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 6A.
W79-09635

URBAN DEVELOPMENT IN THE LOUISIANA COASTAL ZONE: PROBLEMS AND GUIDELINES,
New Orleans Univ., LA. Urban Studies Inst.
For primary bibliographic entry see Field 6A.
W79-09637

6G. Ecologic Impact Of Water Development

THE IMPACT OF THE COLUMBIA GENERATING STATION ON THE SURFACE AND GROUNDWATER HYDROLOGY OF A RIVER FLOODPLAIN WETLAND,
Wisconsin Univ.-Madison. Dept. of Geology.
For primary bibliographic entry see Field 2I.
W79-09586

LIBRARY U. OF L. LOUISIANA - LAFAYETTE

THE USE OF MODELS TO STUDY WETLAND REGULATION OF NUTRIENT LOADING TO LAKE MENDOTA,
Wisconsin Univ.-Madison. Dept. of Botany.
For primary bibliographic entry see Field 6A.
W79-09600

CONCEPTUAL MODELING OF COASTAL WETLANDS IN SOUTHWESTERN LOUISIANA AND SOUTHEASTERN TEXAS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
L. M. Bahr, Jr., J. W. Day, Jr., and J. G. Gosselink.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 253-264, 1978, 3 fig, 10 ref.

Descriptors: *Coastal marshes, *Wetlands, *Systems analysis, *Gulf Coastal Plain, Habitats, Ecosystems, Drainage basins, Hydrology, Primary productivity, Management, Erosion, Canals, Economics, Louisiana, Texas.

The model describes three levels of resolution: the region, the habitat and the drainage basin. From a management-oriented standpoint, the optimum level of resolution at which to examine this complex system was determined to be the intermediate drainage basin level. The drainage basin model functions according to interactions among four components: hydrologic processes, natural resource productivity, physiographic processes and socioeconomic processes. The generalized Chenier Plain basin ecosystem and its critical wetland component is basically driven by hydrologic forces, under the influence of human alterations. Basin changes are expressed primarily in the form of habitat area changes (notably wetland loss) and reduction in natural resource productivity of the basin as a whole. (See also W79-09581) (Stihler-Mass)
W79-09601

FRESHWATER WETLANDS: ECOLOGICAL PROCESSES AND MANAGEMENT POTENTIAL.
For primary bibliographic entry see Field 2I.
W79-09609

EFFECTS OF CANALS ON FRESHWATER MARSHES IN COASTAL LOUISIANA AND IMPLICATIONS FOR MANAGEMENT,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
J. H. Stone, L. M. Bahr, Jr., and J. W. Day, Jr.
In: Freshwater Wetlands: Ecological Processes and Management Potential, 1978, R. E. Good, D. F. Whigham and R. L. Simpson, editors, Academic Press, New York, p 299-320. 5 fig, 5 tab, 35 ref.

Descriptors: *Wetlands, *Freshwater, *Coastal Plain, *Channeling, Flow, Water quality, Marshes, Coastal marshes, Louisiana, Management, Hydrology, Vegetation, Phosphorus, Eutrophication, Simulation analysis, Impoundments, Spoil banks, Channels, Ecology.

Water flow and quality determine and control species composition and function in the freshwater marshes of coastal Louisiana. Man's activities alter this when he disrupts or removes the marsh. For example, man-made canals can change the hydrologic regime, depending on its alignment and local elevations, from -1% to -35% of normal flow. This in turn likely accelerates land loss from increased wave action. It is estimated that perhaps 172 hectares per year of freshwater marsh in coastal Louisiana is being lost due to man's activities. Canals also tend to divert runoff water away from the marsh (where it would be purged of pollutants) to open water bodies, thereby probably causing eutrophication. For example, the P loading rate of several freshwater lakes in the upper Barataria Basin is estimated between 1.5 and 4.3 g/sq m/yr, which may be from 4 to 11 times greater than the loading limit for eutrophication. We do not know how these effects are quantitatively coupled to primary production, consumers in general, and fishery harvest in particular. But on the basis of preliminary data, we suggest that decision makers make full use of computer simulation models, of energy cost accounting, and of other more specific recommendations for marsh management. (See also W79-09609) (Stihler-Mass)
W79-09629

A GUIDE TO THE COASTAL WETLANDS REGULATIONS OF THE MASSACHUSETTS WETLAND PROTECTION ACT (G.L. 131, S. 40).
Massachusetts Dept. of Environmental Quality Engineering, Boston. Div. of Wetlands.
For primary bibliographic entry see Field 6E.
W79-09640

THE IMPACT OF MAN ON SEAGRASS SYSTEMS,
National Marine Fisheries Service Beaufort, NC. Atlantic Estuarine Fisheries Center.
G. W. Thayer, D. A. Wolfe, and R. B. Williams.
American Scientist, Vol. 63, No. 3, p 288-296, 1975. 5 fig, 47 ref.

Descriptors: *Marine plants, *Environmental effects, Aquatic plants, Rooted aquatic plants, Submerged plants, Estuaries, Water pollution, Dredging, Aquatic habitats.

An evaluation is made on the basis of existing information, of the probable value of seagrass communities to man's total ecosystem and the impact of man's varied activities upon seagrass communities, with special reference to Zostera marina communities. Of the several human activities which affect, or can be inferred to affect, success of seagrass communities in estuarine and coastal ecosystems, only a few have so far been documented as actually being deleterious. In general, dredging and other disturbances of the bottom sediments or sedimentation rates can destroy several seagrass species. Additions of toxic materials have been shown to affect animal components of seagrass communities but not the seagrass itself; thermal wastes have been shown to affect both the animal components and, in the case of Thalassia, the grass itself. Commercial fishing on seagrass bottoms, like dredging, can disrupt the growth of the plants. (Steiner-Mass)
W79-09646

ELEMENT CYCLES AND WATER BUDGET ANALYSES APPLIED TO FOREST MANAGEMENT IN THE EASTERN UNITED STATES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-09719

7. RESOURCES DATA

7A. Network Design

PRIMARY PRODUCTION PROCESSES: SUMMARY AND RECOMMENDATIONS,
Mississippi State Univ., Mississippi State.
For primary bibliographic entry see Field 2I.
W79-09615

DECOMPOSITION PROCESSES: SUMMARY AND RECOMMENDATIONS,
Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 2I.
W79-09620

NUTRIENT DYNAMICS: SUMMARY AND RECOMMENDATIONS,
Marine Biological Lab., Woods Hole, MA. Boston Univ. Marine Program.
For primary bibliographic entry see Field 2I.
W79-09626

MANAGEMENT POTENTIAL SUMMARY AND RECOMMENDATIONS,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W79-09632

7B. Data Acquisition

WETLANDS: ECOLOGY, VALUES, AND IMPACTS, PROCEEDINGS OF THE WAUBESA CONFERENCE ON WETLANDS, JUNE 2-5, 1977, MA DISON, WISCONSIN.
For primary bibliographic entry see Field 2I.
W79-09581

COVER MAPPING WETLAND AREAS WITH THE AID OF 35 MM LOW ALTITUDE COLOR PHOTOGRAPHY,
Wisconsin Dept. of Natural Resources, Oshkosh.
A. F. Linde, and T. P. Janisch.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 306-323, 1978. 5 tab, 3 ref.

Descriptors: *Wetlands, *Mapping, *Aerial photography, *Remote sensing, Vegetation, Rooted aquatic plants, Submerged plants, Terrain analysis, Methodology, Wisconsin.

The best time to record species associations and monotypes as delineated by color patterns is after wetland vegetation has changed color following the first frosts. The authors found that the best altitudes for oblique color photography were between 800 and 1500 ft; vertical photography was accomplished between 1000 and 3000 ft. Field maps are constructed by projecting 35 mm color slides of an area and tracing the color patterns which indicate the species associations or monotypes. The maps are ground checked to determine what species the color patterns represent. After ground checking the color patterns are transferred by projection to a base map of suitable scale. Submergent vegetation beds are usually visible in low altitude aerial color photography if the stands are of any consequence. Ground checks of submerged vegetation are made in July and August. (See also W79-09581) (Stihler-Mass)
W79-09605

DEVELOPMENT OF STANDARDIZED PROCEDURES FOR LEACHATE GENERATION,
METREK, Concord, MA.
H. I. Abelson, W. C. Lowenbach, and F. Ellerbusch.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 188-190, 1977.

Descriptors: *Leachate, *Testing procedures, *Analytical techniques, Hydrogen ion concentration, Acidity, Alkalinity, Particle size, Flow rate, Volume, Water pollution sources.

Available leachate assessment techniques are surveyed, and relevant test parameters which should be considered in the development of a standardized test of leachate, are discussed. The shake test, the column test, and the field test call are reviewed briefly. The following parameters are discussed which define eluant characteristics and composition: pH, total acidity/alkalinity, dielectric constant, Eh (aerobicity), organic constituents, liquid-to-solid ratio, test duration, particle size, agitation, eluant cycles, flow rate, sample compaction, total eluant volume, and particle/column diameter ratio. (See also W79-09678) (Small-FRC)
W79-09702

SUITABILITY OF CLAY BEDS FOR STORAGE OF INDUSTRIAL SOLID WASTES,
Texas Univ. at Austin.
E. F. Gloyna, and R. L. Sanks.
In: Proceedings of the 1977 National Conference on Treatment and Disposal of Industrial Wastewaters and Residues, April 26-28, 1977, Houston, Texas, p 209-215, 1977. 4 fig, 6 tab, 22 ref.

Descriptors: *Landfills, *Clays, *Industrial wastes, *Analytical methods, *Soil contamination, Solid wastes, Water pollution sources, Leachate, Soil chemistry, Design criteria.

Test procedures are described to determine the suitability of clay beds for the containment of industrial solid wastes. Test procedures were developed for measuring the action of a wide range of potential soil pollutants. Factors which affected determination repeatability and accuracy were investigated. Also, transport characteristics of a few diversified materials were studied. Five clays were tested with aqueous solutions of hydrochloric acid, sodium hydroxide, acetone, acetaldehyde, benzene, phenol, lead chloride, mercuric chloride, chromium chloride, and DDT. Clay characteristics such as grain size distribution, Atterberg limits, mineralogy, carbonate content, and cation exchange capacity, are presented. A generalized design is presented for an industrial landfill with a clay liner. (See also W79-09678) (Small-FRC)
W79-09706

THE OFFSHORE ENVIRONMENT: A PERSPECTIVE FROM SEASAT-1 SAR DATA,
Geological Survey, Reston, VA. Geologic Div.
P. G. Teleki, W. J. Campbell, R. O. Ramseier, and D. Ross.
Paper OTC 3382, presented at the 11th Annual Offshore Technology Conference, Houston, Texas, April 30-May 3, 1979. 10 p, 11 fig, 13 ref.

Descriptors: *Remote sensing, *Satellites(Artificial), *Ocean waves, *Photogrammetry, Sea ice, Hurricanes, Ocean currents, Design criteria, *Offshore petroleum development, Offshore platforms, Oil shipping.

The short lifetime of NASA's Seasat-1 satellite (June 26-Oct. 10, 1978) was compensated for by the quality of the imagery produced by the synthetic aperture imaging radar (SAR). The limited amount of SAR data processed so far, indicate that the ocean-wave imaging capability ranges from waves produced in the generally low sea-state conditions during the summer months of 1978 to those produced under hurricane-force conditions, and that the high-density radar coverage in the Arctic can be used to chart the distribution of sea ice that has varying surface morphology. Additionally, information on the mechanics of currents and internal waves may be derivable. The areas covered by Seasat-1 correspond to many of North America's and Europe's petroleum development regions, and the acquired SAR data may be useful as a synoptic overview of possible oceanic processes and, through model calibration, to offshore shipping and oil and gas operations and to evaluating design concepts for offshore structures. (Woodard-USGS)
W79-09728

A SYNOPTIC APPROACH FOR ANALYZING EROSION AS A GUIDE TO LAND-USE PLANNING,
Geological Survey, Menlo Park, CA. Water Resources Div.; and Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 4D.
W79-09730

CAROLINA BAYS ON THE EASTERN SHORE OF VIRGINIA,
Soil Conservation Service, Smithfield, NC.
For primary bibliographic entry see Field 2L.
W79-09769

7C. Evaluation, Processing and Publication

WETLAND MAPPING USING EXISTING INFORMATION SOURCES,
Wisconsin Univ.-Madison. Dept. of Soil Science.
C. A. Johnston.
In: Wetlands: Ecology, Values, and Impacts, Proceedings of the Waubesa Conference on Wetlands, June 2-5, 1977, Madison, Wisconsin, p 290-305, 1978, 7 fig, 16 ref.

Descriptors: *Wetlands, *Mapping, *Methodology, Aerial photographs, Soils, Vegetation, Wildlife, Logging, Agriculture, Geological surveys, Wisconsin.

A great deal of wetland information can be gleaned from existing data sources, providing they are properly interpreted. Air photos, soil maps, and other source materials were used to map wetland vegetation, soils, and water regimes in study sites representative of different wetland types and conditions throughout Wisconsin. Ancillary surveys of various types (e.g., topographic maps, land cover inventories) augmented the basic data sources. Air photos were also used to interpret adjacent land uses which might affect wetland quality. Historical air photos and references provided important clues about past wetland disturbances. Maps generated by these techniques can be helpful in identifying, delineating, evaluating, and managing wetlands. (See also W79-09581) (Stihler-Mass)
W79-09604

WATER RESOURCES DATA FOR ILLINOIS, WATER YEAR 1978--VOLUME 1. ILLINOIS EXCEPT ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 416, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report IL-78-1, April 1979. 315 p, 4 fig.

Descriptors: *Illinois, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Volume 1(excludes Illinois River basin).

Water resources data for the 1978 water year for Illinois, contained in two volumes, consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of groundwater wells. Volume 1 contains records (excluding Illinois River basin) for water discharge at 80 gaging stations, stage only at 3 gaging stations, stage and contents at 3 lakes and reservoirs, stage only at 2 lake stations, and water quality at 91 gaging stations and 28 wells. Also included are data for 49 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local and Federal agencies in Illinois. (See also W79-09727) (Woodard-USGS)
W79-09726

WATER RESOURCES DATA FOR ILLINOIS, WATER YEAR 1978--VOLUME 2. ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 417, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report IL-78-2, April 1979. 327 p, 4 fig.

Descriptors: *Illinois, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Illinois River basin.

Water resources data for the 1978 water year for Illinois, contained in two volumes, consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of groundwater wells. Volume 2 contains records (in the Illinois River basin) for water discharge at 84 gaging stations, stage only at 2 gaging stations, stage only at 3 lake stations, water quality at 70 gaging stations and 28 wells, and water levels at 3 observation wells. Also included are data for 102 crest-stage partial-record stations and 42 flood-profile stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume I represent that part of the National Water Data System operated by the U.S. Geological and cooperating State, local, and Federal agencies in Illinois. (See also W79-09726) (Woodard-USGS)
W79-09727

WATER RESOURCES DATA FOR MARYLAND AND DELAWARE, WATER YEAR 1978,
Geological Survey, Towson, MD. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 418, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MD-DE-78-1, April 1979. 322 p, 4 fig.

Descriptors: *Maryland, *Delaware, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Estuaries, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 102 gaging stations, stage and contents at 1 reservoir, water quality at 52 gaging stations and 72 wells, and water levels at 28 observation wells. Also included are data for 17 crest-stage, 86 low-flow, and 4 tidal crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (Woodard-USGS)
W79-09733

WATER-RESOURCES INVESTIGATIONS IN TEXAS, FISCAL YEARS 1978 AND 1979,
Geological Survey, Austin, TX. Water Resources Div.
H. D. Buckner, and A. A. Mitchell.
Geological Survey Texas District report, January 1979. 27 p, 17 ref.

Descriptors: *Hydrologic data, *Data collections, *Texas, *Projects, Surface waters, Groundwater resources, Water quality, Streamflow, Sediment transport, Reservoirs, Water wells, Aquifers, Drawdown, Land subsidence, Water levels, Estuaries, Tides, Chemical analysis, Sampling, Sites, Maps, Flood plains, Cooperatives.

This report describes the water-resources projects and activities of the U.S. Geological Survey in Texas for the 1978 fiscal year (October 1, 1977, to September 30, 1978), and the 1979 fiscal year (October 1, 1978, to September 30, 1979). A continuing series of measurements and analyses are made of streamflow, reservoir contents, and estuarine flow. In addition, data are collected on the chemical quality of water, sediment in streams and reservoirs, water levels in wells, and land-surface subsidence. By th end of the 1977 fiscal year, the following installations will be in operation: Approximately 689 digital recorders at stream-gaging, tide-level, and rainfall stations; 22 conductivity (digital) recorders; 5 instruments for continuously monitoring and recording the water-quality characteristics of conductivity, water temperature, dissolved oxygen, and pH; and 3 continuous record-

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ers for water temperature. Ground-water data are collected at more than 1,100 observation wells. Water levels are measured continuously in 33 wells and periodically in 996 wells; chemical-quality data are collected in 293 wells; and subsidence data are collected in 13 wells. (Woodard-USGS)
W79-09744

VARIATION OF MANNING'S N ROUGHNESS COEFFICIENT WITH FLOW IN OPEN RIVER CHANNELS,
Forth River Purification Board, Edinburgh (Scotland).
For primary bibliographic entry see Field 2E.
W79-09754

8. ENGINEERING WORKS

8B. Hydraulics

SHAPE EFFECTS ON RESISTANCE TO UNIFORM FLOW IN OPEN CHANNELS,
Queensland Univ., Brisbane (Australia). Hydraulic Engineering.
For primary bibliographic entry see Field 2E.
W79-09757

8I. Fisheries Engineering

EFFECTS OF FEEDING RATE ON WATER QUALITY, PRODUCTION OF CHANNEL CATFISH, AND ECONOMIC RETURNS,
Auburn Univ., AL.
For primary bibliographic entry see Field 5G.
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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 23
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W79-09831 -- W79-10080

Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

DEVELOPMENT OF AN EXTENSION OF ILLUDAS MODEL FOR CONTINUOUS SIMULATION OF URBAN RUNOFF QUANTITY AND DISCRETE SIMULATION OF RUNOFF QUALITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. Han, and J. W. Delleur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 483, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No. 109, July 1979. 136 p, 20 fig, 25 tab, 31 ref, 3 append. OWRT C-6106 (no. 5213) (10).

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Simulation models, Storm runoff, Urban drainage, Soil moisture, Evaporation, Infiltration, Hydrograph, ILLUDAS.

Two short-time-interval simulation models were developed: the first is a continuous simulation of storm water runoff quantity, and the second is a single event runoff quality model. Both models are extensions of the Illinois Urban Drainage Area Simulator, ILLUDAS, and were verified on the Upper Ross-Ade Watershed in West Lafayette, Indiana. A time increment equal to the average inlet time of 5 minutes was the largest one giving acceptable hydrograph results for the watershed under study. The ILLUDAS model was extended to allow for a continuous simulation of the urban runoff. This was done by adding the subroutine DRYAMC which calculates the total rainfall during the five days preceding the storm to determine the antecedent moisture condition at the beginning of each storm. Further, the single event rainfall-runoff model ILLUDAS was coupled with a modified version of the runoff quality model STORM. In this fashion an integrated runoff quantity and quality model DRAINQUAL is obtained with the capability of simulating a pollutograph at 5 minute time intervals. Comparison with field measurements shows that the model predicts the BOD and suspended solids pollutographs fairly well.
W79-09832

A MATHEMATICAL MODEL OF STRATIFIED, BIDIRECTIONAL FLOW IN SHORT CULVERTS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
D. G. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 494, Price codes: A05 in paper copy, A01 in microfiche. MS. Thesis, 1979. 75 p, 25 fig, 1 tab. OWRT-B-139-UTAH (5), 14-34-0001-7191.

Descriptors: *Computer models, Density stratification, Percolation, Finite element method, Continuity equation, Convection-diffusion, Culverts, *Stratified flow.

A two-dimensional computer model, simulating bidirectional, density-stratified gravity flow in the vertical plane is developed. The finite element method is applied to the governing equations, i.e., the equations of motion, continuity and convection-diffusion, to obtain a well-posed boundary value problem. The convection-diffusion equation is written in terms of the density difference between the unknown fluid density and the density of pure water. The dependent variables used in the system of equations are the horizontal and vertical components of velocity, the pressure and the density difference. The basic finite element shape is triangular. Both linear and isoparametric elements with six nodes (three nodes at the vertices and three on the mid-sides) are employed. Quadratic interpolation of the velocity variables is coupled with linear interpolation of both pressure and density. Assumptions consistent with the application to gravity flow in culverts are identified. The Galerkin method of weighted residuals is used to form suitable finite element equations. The nonlinear system of equations is solved using the Newton-Raphson iterative technique. Bidirectional flow is known to exist in the culverts located in the railroad causeway of the Great Salt Lake. The discharges, densities, temperatures, interface location, and head differences across the causeway were measured on a monthly basis, from October 1968 to September 1972, by the U.S. Geological Survey. This data was used to verify the mathematical model.
W79-09835

WATER QUALITY CHARACTERISTICS OF THE HORSE CREEK WATERSHEDS IN NORTH CENTRAL IDAHO,
Idaho Univ., Moscow.
J. G. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 487, Price codes: A07 in paper copy, A01 in microfiche. University of Idaho. Research Technical Compltion Report, May 1979. 129 p, 33 fig, 46 tab, 67 ref, 8 append. OWRT A-051-IDA (1).

Descriptors: *Watersheds(Basins), *Sediment yield, *Geomorphology, *Sedimentology, Forest watersheds, Watershed management, Water quality, Water chemistry, Runoff, Snowmelt, Idaho, Bed load, Sediment load, Discharge(Water).

Ten undisturbed forested watersheds were analyzed to provide a means of watershed classification. The water quality processes of the watersheds were described and quantified, and the influences of geomorphology, climate, and channel stability on these processes were determined. The two most useful geomorphic descriptions in evaluating sedimentation differences were total basin area and relief ratio. Bedload transport rates and suspended sediment concentrations were monitored for three water years. Total annual sediment yields show a great deal of variability largely due to differences in water yields influenced by snowmelt volumes and rates. Approximately 95% of annual sediment production occurs during the snow melt season. Organic content and particle size distribution were determined for the transported bedload sediment and total sediment deposited in debris basins at the mouth of each watershed. Approximately 11% of the total deposited sediment was organic matter. Approximately 77% of the sediment transported in suspension was flushed through the debris basins resulting in low trap efficiency. The concentrations of sulfate, calcium, magnesium, potassium, and sodium, pH, specific conductivity, and alkalinity were low and were inversely related to stream discharge. Water quality and sedimentation are related to geomorphology and the use of geomorphologic parameters will provide better areal extrapolation of research results. (Seigler-IPA)
W79-09838

THE PREDICTION OF MEAN MONTHLY SOIL TEMPERATURE FROM MEAN MONTHLY AIR TEMPERATURE,
Denver Univ., CO. Dept. of Geography.
T. J. Toy, A. J. Kuhaida, and B. E. Munson.
Soil Science, Vol. 126, No. 3, p 181-189, September, 1978. 4 fig, 3 tab, 13 ref.

Descriptors: *Soil temperature, Air temperature, Climatic data, *Estimating equations, Model studies.

Though soil temperature is important to a variety of earth science subdisciplines, data are collected at few locations. This report presented simple, linear models for estimating mean annual, seasonal, and monthly soil temperatures with reasonable accuracy, using only air temperature data. A general equation based on all months and all sample stations taken together, seasonal equations, and equations for individual stations were provided. These models can be used to estimate soil temperature from air temperature data collected by the National Weather Service at stations throughout the United States. (Skogerboe-Colorado State)
W79-09906

PROCESS AND SYSTEM FOR RECOVERING WATER FROM THE ATMOSPHERE,
Mittex A.G., Vaduz (Liechtenstein).
W. Groth, and P. Hussmann.
U.S. Patent No. 4,146,372, 15 p, 4 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1384, March 27, 1979.

Descriptors: *Patents, Meteoric water, Water harvesting, Atmosphere, Moisture availability, Temperature, Adsorption, Condensation, Silica, Gels, Equipment.

Water is recovered from air by a process utilizing the differences in the day-time and night temperatures of such air. The process is especially useful in subtropical desert areas. It consists in alternately removing the moisture from the cool night air by adsorption on suitable adsorbing agents and especially on silica gel and by utilizing the hot day-time air and, if desired and available, the radiation energy of the sun for desorption of the water stored in the adsorbing agent and for condensing the desorbed water by means of the cold stored during the night. An especially suitable silica gel is used for adsorption of the water contained in the air. The energy required for operating the plant is produced by passing the recovered water through energy producing installations such as turbines before it is used as drinking water or for irrigation. The process is very economical and, in contrast to seawater desalination processes, does not require additional thermal energy. (Sinha-OEIS)
W79-09940

EXPERIMENTAL CONTROL OF BEACH FACE DYNAMICS BY WATERTABLE PUMPING,
Australian National Univ., Canberra (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2L.
W79-09971

2B. Precipitation

A CLOUD-SEEDING EXPERIMENT IN TASMANIA,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
E. J. Smith, L. G. Veitch, D. E. Shaw, and A. J. Miller.
Journal of Applied Meteorology, Vol. 18, No. 6, p 804-815, June 1979. 3 fig, 9 tab, 12 ref, 1 append.

Descriptors: *Cloud seeding, *Weather modification, *Rainfall, *Australia, On-site investigations, Aircraft, Silver iodide, Statistics, Statistical methods, Regression analysis, Analytical techniques, Meteorology, *Tasmania.

A cloud-seeding experiment was conducted in Tasmania using a target area and three control areas. Seeding was on a random basis using silver-iodide smoke released from an aircraft. Evidence was presented that seeding increased rainfall in the eastern half of the target area during autumn. (Sims-ISWS)
W79-09963

SPATIAL CORRELATIONS OF MONTHLY RAINFALL: APPLICATIONS IN CLIMATOLOGY AND WEATHER MODIFICATION EXPERIMENTS,
Oak Ridge National Lab., TN.
A. A. N. Patrinos, N. C. J. Chen, and R. L. Miller.
Journal of Applied Meteorology, Vol. 18, No. 6, p 719-732, June 1979. 13 fig, 5 tab, 31 ref. DOE W-7405-eng-26.

Descriptors: *Rainfall, *Spatial distribution, *Correlation analysis, *Georgia, Powerplants, Effects, Weather modification, Distribution patterns, Winds, Rain, Precipitation(Atmospheric), Variability, Topography, Cooling water, Heated water, Climatology, Meteorology.

Spatial correlations based on monthly rainfall totals from northwest Georgia for the period 1949-

77 were studied. This work, a part of the Meteorological Effects of Thermal Energy Releases (METER) Program, determined natural variability rainfall trends and assisted the field studies of potential precipitation effects of the Bowen Electric Generating Plant near Cartersville, Georgia. The spatial correlations, based on the overall record as well as the stratified data in terms of 'wet' and 'dry' seasons, were investigated with regard to distance between stations, wind direction, and topography. The results indicated a strong dependence of the spatial correlation patterns on the prevailing storm tracks in the area. A method was developed using the spatial correlation as an indicator of effects on weather modification experiments. This method was based on the generation of empirical distribution functions by randomization for various sample sizes. The application of this technique to the Plant Bowen study in a control target statistical design revealed preliminary positive evidence of rainfall modification in the target area. (Sims-ISWS)
W79-09964

CHANGES IN CLOUD BASE PRECIPITATION PARTICLE SIZE-DISTRIBUTIONS AS A RESPONSE VARIABLE TO SEEDING,
Meteorology Research, Inc., Altadena, CA.
D. M. Takeuchi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 549, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. MRI 79 TR-1683, June 26, 1979. 28 p, 9 fig, 5 tab, 3 ref. 14-06-D-7699.

Descriptors: *Cloud seeding, *Weather modification, *Precipitation(Atmospheric), *Cloud physics, Snow, Hail, Particle size, Rainfall, Montana, Convection, Chemistry of precipitation, Silver iodide, Carbon dioxide.

A statistical analysis was performed on measurements of changes in precipitation particle size distributions of subcloud and cloud base regions of seeded and non-seeded summertime convective clouds. Measurements were taken with PMS wide arm 1-D precipitation probe by the MRI Navajo cloud physics aircraft during the summers of 1976 and 1977 near Miles City, Montana. Horizontal penetrations were made through the center of the precipitation shaft. Sample procedures were identical for both seeded (Ag I and CO2) and nonseeded clouds. For given intensities, the natural size spectra differs significantly among natural clouds producing precipitation of: (1) snow, (2) rain and/or graupel, and (3) hail with graupel and/or rain. Results show that: (1) in snow producing clouds, seeding increases the number concentrations of the larger particle; (2) in rain and/or graupel producing clouds, seeding produces significantly higher total number concentrations and results in lower number concentrations at the larger particle sizes; and (3) in hail producing clouds, seeding creates increased numbers of large particles, but the changes were not significant at the 5% level of significance. (Seigler-IPA)
W79-10025

MID-EOCENE CLIMATIC CHANGE, SOUTHWESTERN CALIFORNIA AND NORTHWESTERN BAJA CALIFORNIA,
San Diego State Univ., CA. Dept. of Geological Sciences.
G. L. Peterson, and P. L. Abbott.
Palaeogeography, Palaeoclimatology, Palaeoecology, Vol. 26, No. 1/2, p 73-87, February 1979. 3 fig, 1 tab, 43 ref.

Descriptors: *Paleoclimatology, *Paleolimnology, *Paleosols, *Geologic history, *Stratigraphy, History, Paleohydrology, Geologic time, Climatic data, Climatology, Climatic change, Sedimentary petrology, Sedimentology, Sedimentary rocks, Dating, California, Baja California, Cenozoic era, Tertiary period.

A comparison of some sedimentary characteristics in southwestern California and northwestern Baja California reveals a profound climatic change since Paleocene time. Data presented here demonstrate Eocene climatic change and describe distribution and character of evidence upon which this thesis is based. While the severely weathered, differentially preserved and buried Eocene rock units in the California area of this region are believed to have developed under humid tropical conditions prevailing during Paleocene/mid-Eocene period, a variety of Middle and Upper Eocene sedimentary formations overlie this ancient soil profile that are strongly indicative of a semiarid Paleoclimate. Rainfall during this period is believed to have been less than 63 cm/yr, seasonal, and characterized by flash floods. Fluvial conglomerates indicate that chemical weathering and rainfall were minimal, thus the river system probably was ephemeral. A tabulated comparison of the various time periods indicates that the Late Eocene was much closer to the present climate in the area than that during any other period, and suggests that a climatic change of the type and magnitude described should be reflected on a regional if not global scale. (Tickes-Arizona)
W79-10076

RAINFALL IN SOUTHERN CALIFORNIA,
San Diego State Univ., CA. Dept. of Geological Sciences.
M. Sheely, and C. E. Dorman.
Weatherwise, Vol. 32, No. 3, p 119-122, June, 1979. 3 fig, 2 tab, 4 ref.

Descriptors: *Atmospheric precipitation, *Rainfall disposition, *Depth-area-duration analysis, *Atmospheric pressure, Meteorological data, Air environment, Physical properties, Correlation analysis, Forecasting, California.

The relationship between variations in the South Pacific pressure gradient and anomalous rainfall in the Southern California highland is examined here as a tool for forecasting if the next season in southern California will be anomalously wet or dry. To explore this relation the Cuyamala Reservoir in California was selected for comparison with 21 other stations in the southwestern U.S. and rainfall pattern similarities were determined by correlating monthly rainfall totals. The resultant contour map of correlation coefficients indicates that correlations diminish slowly toward the north and parallel the high elevations but dramatically decrease in an east-west direction with the terrain. Of the six significantly wet years shown here, 5 were associated with a pressure gradient of less than 5.7 mb in September of that rainyear and 5.7 mb in September is considered to be a good indicator of a wet year in the southern California mountains. This inverse relationship is of particular value in estimating water resources, fire hazards, and flooding potential in the southern California mountains. (Tickes-Arizona)
W79-10078

2C. Snow, Ice, and Frost

THE FORMATION OF MEDIAL MORAINES ON ALPINE GLACIERS,
Southampton Univ. (England). Dept. of Geography.
R. J. Small, M. J. Clark, and T. J. P. Cawse.
Journal of Glaciology, Vol. 22, No. 86, p 43-52, 1979. 4 fig, 3 tab, 14 ref.

Descriptors: *Glaciers, *Glacial drift, *Alpine, Till, Ablation, Growth rates, Melting, On-site investigations, Ice, Rocks, Glaciology, *Switzerland, Medial moraines, Englacial till, Debris.

Field investigation of 6 medial moraines on glaciers near Arolla, Valais, Switzerland, has revealed that all are nourished by englacial till. This is probably derived from supraglacial point-sources on the accumulation zones of the glaciers, and is released in increasing quantities on the ablation zones, where it emerges diffusely or by way of clearly defined transverse or longitudinal debris bands. Possible mechanisms of formation of these debris bands were reviewed, and it was proposed that the transverse bands originated as crevasse fillings on the accumulation zones. Morphologically, all 6 moraines display waxing sections (of increasing height and breadth), related to development of a protective till cover and resultant differential ablation of the glacier surface. Two only display waning sections (of decreasing height), resulting from lateral sliding of till and 'inverted' differential ablation resulting from extreme attenuation of till cover. Four 'moraine-types' (related to nature of debris supply and detailed morphology) were identified in the Arolla area. It is believed that these may form the basis for a classification of medial moraines. (Sims-ISWS)
W79-09973

PATTERN OF ICE SURFACE LOWERING FOR RENNICK GLACIER, NORTHERN VICTORIA LAND, ANTARCTICA,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
P. A. Mayewski, J. W. Attig, Jr., and D. J. Drewry.
Journal of Glaciology, Vol. 22, No. 86, p 53-65, 1979. 7 fig, 2 tab, 11 ref. NSF OPP74-15210.

Descriptors: *Glaciers, *Antarctic, *Glaciation, Ice, Movement, Surfaces, Glacial drift, On-site investigations, Remote sensing, Fluctuations, Sea level, Glaciology, *Rennick Glacier(Antarctic), *Victoria Land(Antarctic).

Rennick Glacier is one of the major ice drainages in northern Victoria Land. Unlike glaciers farther south along the Transantarctic Mountains, Rennick Glacier does not drain into the Ross Ice Shelf but flows directly into a seasonally ice-covered ocean. Therefore, current fluctuations of this glacier are unhampered by the dampening effects of the Ross Ice Shelf. The primary controls on the activity of this glacier and others in this region are mass balance and sea-level. Two major glacial events were recorded in the upper Rennick Glacier region. The location of erratics and glacially scoured features suggest that during the oldest or Evans glaciation, ice covered all but the highest peaks in the region. Following this glaciation, a readvance produced the Rennick glaciation. Drift produced during this glaciation has a surface cover of unweathered clasts and is commonly found in the form of recessional moraines with associated ice-marginal lakes. Rennick Glacier is currently in a recessional phase of the Rennick glaciation. The phase is characterized by physical re-adjustments of local ice masses including progressive inland migration of the Rennick Glacier grounding line. To date, the grounding line has migrated up to the mid-point of the glacier. This trend may be expected to continue. (Sims-ISWS)
W79-09974

GRAIN COARSENING OF WATER-SATURATED SNOW,
Washington Univ., Seattle. Geophysics Programs.
C. F. Raymond, and K. Tusima.
Journal of Glaciology, Vol. 22, No. 86, p 83-105, 1979. 8 fig, 5 tab, 17 ref.

Descriptors: *Snow, *Particle size, *Aging(Physical), Laboratory tests, Freezing, Melting, Heat flow, Heat transfer, Growth rates, Ice, Physical properties, Grain coarsening, Water-saturated snow.

Experimental measurements were made of changes in grain-size distribution with time in snow saturated with solutions of various impurity contents. Qualitatively, the changes in grain-size distribution occur by shrinkage and eventual disappearance of the relatively small particles and growth of the relatively large particles by a solid mass-exchange process which conserves the total solid mass. The distribution of relative lasting only several to several tens of hours after the time of initial saturation. Mean grain volume increased at a constant rate, which for solutions of impurity concentration less than about 0.01 mol/l was 0.005 to 0.006 cu mm/h. Once the steady relative-size distribution was established, the rate of volume change of typical grains varied linearly with grain volume from the characteristic negative rate for the smallest particles through 0 for particles of mean volume to positive values for particles of larger volume. (Sims-ISWS)
W79-09975

2D. Evaporation and Transpiration

THE ROLE OF EVAPOTRANSPIRATION MODELS IN IRRIGATION SCHEDULING,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
M. E. Jensen, and J. L. Wright.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 82-87, February 20, 1978. 4 fig, 2 tab, 25 ref.

Descriptors: Scheduling, Irrigation, *Evapotranspiration, *Model studies, Soil moisture, Statistical methods, *Irrigation scheduling.

Most evapotranspiration (ET) models are based on physical principles controlling evaporation and the conservation of mass and energy, and use daily climatic data. ET models coupled with irrigation models are valuable tools because they enable trained and experienced irrigation specialists to provide irrigation scheduling services at a reasonable cost. Estimated standard deviations of mean daily ET for 1- to 30-day periods at Akron, Colorado; Davis, California; Kimberly, Idaho; and Lompoc, California varied from 0.9 to 1.3 mm/day and it decreased to 0.4 to 0.7 mm/day for 15- to 30-day periods. Standard errors of ET estimates with a combination equation based on 243 days of data from Kimberly, Idaho were normally distributed and for daily values the standard error was 1.0 mm/day. This parameter decreased inversely with the square root of the number of days for up to 30 days and was similar to those reported for other areas using models that operate on daily climatic data. A summary of factors affecting confidence levels in irrigation scheduling was presented along with the expected standard deviations. Generally, the error in measuring soil moisture was generally smaller than estimated ET and irrigation application errors. (Skogerboe-Colorado State)
W79-09914

2E. Streamflow and Runoff

PROBABILITY DISTRIBUTIONS OF BEST FIT TO SOUTH AFRICAN FLOOD DATA,
Department of Water Affairs, Pretoria (South Africa). Hydrology, Div.
P. T. Adamson.
Water S.A., Vol. 5, No. 21, p 70-76, April 1979. 3 fig, 7 tab, 24 ref.

Descriptors: *Flood forecasting, *Flood profiles, *Design flood, *Mathematical models, Statistical methods, Analytical techniques, Probability, Flood data, Distribution, Numerical analysis, South Africa.

Five statistical models for flood analysis were tested to determine their relative performance as applied to floods in South Africa. The models are: a two parameter log-Normal distribution (LN2), a three parameter log-Normal distribution (LN3), a log-Pearson type 3 distribution (LP3), an extreme value type 1 distribution (EV1), and an extreme value type 2 distribution (EV2). All models were fitted by the method of moments. Fifty South African annual flood peak data sets were fitted to the models. The data have a minimum length of record of 25 years with a mean length of record of 46 years. No tests of homogeneity were applied largely because the correction of the effects of dams, urbanization, improved land drainage, channel improvements, vegetation changes, and improvements to hydrometric structures and ratings would have been too large. Results show: (1) EV1 should be discouraged as a means of statistical annual flood peak analysis in South Africa; (2) the log-Normal 2-parameter and log-Pearson type 3 models, on the evidence of fit alone, provide the 'best' models; (3) the log-Pearson type 3 model gives much higher estimates for return periods greater than 100 years than the log-Normal 2-parameter model; (4) on the average, the log-Normal 3-parameter and the extreme value type 2 models give similar results; and (5) two models are limited by a fixed skew, but the log-Normal 2-parameter model can overcome this when fitted by moments. (Seigler-IPA)
W79-09842

COMPARATIVE EVALUATION OF STATISTICAL METHODS FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen, W. J. Rawls, and B. L. Whaley.
Water Resources Bulletin, Vol. 15, No. 4, p 935-947, August 1979. 1 fig, 3 tab, 6 ref.

Descriptors: *Evaluation, *Statistical methods, *Water supply, *Forecasting, *Hydrologic data, *Mathematical models, Water yield, Seasonal, Comparison, Regression analysis, Streamflow, Volume, Equations, Systems analysis, Upper Sevier River basin(Utah).

While the correlation coefficient and standard error of estimate are frequently used when comparing models of seasonal water yield, the following criteria may be more important in selecting one model from among several alternatives: Rationality of the regression coefficients, the distribution of the residual errors, and the correctness of indicators of the relative importance of the predictor variables. These criteria were used to compare seasonal water yield models that were calibrated using multiple regression, stepwise regression, principal components regression, polynomial regression using a principal components rotation, and constrained pattern search. Hydrologic data from the Upper Sevier River basin in southern Utah were used to illustrate the comparative analysis process. The prediction equations used the April-July streamflow volume as the criterion variable. (Bell-Graf--Cornell)
W79-09870

METHODOLOGY OF STUDIES ON CHEMICAL PROCESSES IN WATER RUNOFF FROM ROCK AND SHALLOW SOIL COVER USING RADIOACTIVE TRACERS,
Institutt for Atomenergi, Kjeller (Norway).
For primary bibliographic entry see Field 2K.
W79-09980

INTERACTION BETWEEN SIMULATED RAIN AND BARREN ROCK SURFACE,
Norske Skogforsoksvesen, Oslo.
For primary bibliographic entry see Field 2K.
W79-09981

FLOOD PLAIN INFORMATION: POJOAQUE RIVER AND TRIBUTARIES, SANTA FE COUNTY, NEW MEXICO,
Army Engineer District, Albuquerque, NM.
Prepared for the County of Santa Fe, NM, August 1977. 32 p, 1 fig, 50 plates, 7 tab.

Descriptors: *New Mexico, *Flooding, *Flood profiles, *Flood data, *Flood stages, *Flood plains, *Santa Fe County(NM), *Pojoaque River(NM), Floods, Indirect flood measurement, Historic floods, Flood frequency, Peak discharge, Flood peak, Flood waves, Flow duration, Flow characteristics, Rivers, Flood protection, Warning systems, Levee, Pojoaque Creek(NM), Rio Tesuque(NM), San Ildefonso(NM), 100-year flood, 500-year flood.

The study area includes the flood plains of the Pojoaque River and its tributaries located in the northwestern portion of Santa Fe County. The flood plain is primarily rural with large amounts of open space. Flood data were obtained from aerial photographs, topographic maps, stream gaging stations, and field surveys. The Corps of Engineers repaired and rebuilt a levee system but this system will not contain an Intermediate Regional Flood and was assumed to be nonexistent for purposes of this study. Major flood-producing storms have been experienced most often during the July, August, and September period. The worst recorded flood in the lower reach of the Pojoaque River below San Ildefonso occurred in 1955, discharging 15,000 cubic feet per second (cfs). The peak discharge of the 100-year flood on the Pojoaque River would be 13,500 cfs, and for its tributaries, Pojoaque Creek and Rio Tesuque, 12,700 cfs and 10,640 cfs, respectively. The peak discharge of the 500-year flood on the Pojoaque River would be 38,600 cfs and for its tributaries, Pojoaque Creek and Rio Tesuque, 36,400 cfs and 30,400 cfs, respectively. This report furnishes a suitable basis for adoption of land use plans to guide flood plain development. (Coan-NC)
W79-10012

FLOOD PLAIN INFORMATION: MIMBRES RIVER AND FLORIDA GAP DRAW, DEMING, LUNA COUNTY, NM.
Army Engineer District, Albuquerque, NM.
Prepared for the Luna County Board of County Commissioners, NM, September 1978. 25 p, 3 fig, 22 plates, 5 tab.

Descriptors: *Flooding, *Flood profiles, *Peak discharge, *Flood plains, *Luna County(NM), *Florida Gap Draw(NM), *Mimbres River(NM), *New Mexico, Floods, Indirect flood measurement, Storms, Cloudbursts, Flood stages, Flood peak, Flow duration, Flow characteristics, Rivers, Flood protection, Warning systems, Deming(NM), 100-year flood, 500-year flood.

The study area is the flood plain of the Mimbres River near Deming in Luna County, New Mexico. Existing developments on the flood plains in the study area are primarily farm homes and associated farm buildings. Flood data were obtained from aerial photographs, field surveys, and historical records. There are no structures in the study area with significant water regulating facilities. Most of the rainfall in the area occurs during the summer months and consists mainly of thunderstorm or cloudburst type. Historical records were searched for past floods in Luna County, but nothing significant was found. The 100-year flood for the Mimbres River is expected to have a peak discharge of 15,700 cubic feet per second (cfs), reach a height of rise of six feet above bankfull stage, and last about 13.4 hours. The 500-year flood on the Mimbres River would have a discharge of 77,270 cfs, reach a height of 5.7 feet above bankfull stage, and last for 23.7 hours. This report will aid in the development of flood damage reduction measures and provide a basis for land use planning in flood plains. (Coan-NC)
W79-10013

FLOOD HAZARD ANALYSES, WORTHLEY BROOK, TOWN OF POLAND, MAINE, ANDROSCOGGIN COUNTY,
Soil Conservation Service, Orono, ME.
September 1977. 6 p, 5 fig, 5 plates, 2 tab.

Descriptors: *Maine, *Floods, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Stage-discharge relations, *Worthley Brook(ME), *Poland(ME), *Androscoggin County(ME), Regional flood, Indirect flood measurement, Flood profiles, Rivers, Flood plains, Flood protection, Flood plain insurance, 100-year flood, 500-year flood.

This report identifies and delineates the flood hazard areas along three miles of Worthley Brook from the Town of Poland in southern Maine. Drainage area of the study reach is about 8.5 miles to its confluence with the Little Androscoggin River. Flood plain width varies from 300 feet up to a maximum of 1000 feet. Development in the flood plain includes part of the Town of Poland, and recreation areas. Though no urban centers exist adjacent to the flood plain, development pressure to build residential dwellings in the area does exist. There are no stream gages on Worthley Brook. Flooding is caused primarily by spring snowmelt and by brief but intense summer storms. Major flooding occurred in March 1936 and March 1953. The 1936 flood is estimated to be in the vicinity of the 100-year flood. The 100-year and 500-year floods are projected to have peak discharges of up to 840 cubic feet per second (cfs) and 1,340 cfs, respectively. No existing or planned structural measures are known that would affect flooding. This report is intended to provide a technical basis for flood plain management; suggestions include institution of land use planning, flood plain acquisi-

tion and regulations, and the use of conservation easements. (Arnold-NC)
W79-10014

2F. Groundwater

EXPERIMENTAL CONTROL OF BEACH FACE DYNAMICS BY WATERTABLE PUMPING,
Australian National Univ., Canberra (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2L.
W79-09971

NITROGEN-ISOTOPE RATIO STUDIES OF SOILS AND GROUNDWATER NITRATE FROM ALLUVIAL FAN AQUIFERS IN TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 5B.
W79-09983

AN ANALYTICAL SOLUTION FOR THE TRANSIENT DITCH DRAINAGE PROBLEM,
Center for Water Resources Development and Management, Trivandrum (India).
For primary bibliographic entry see Field 2G.
W79-09984

LAGOON RECHARGE OF THE FOLKESTONE BEDS AT HARDHAM, SUSSEX--1972-75,
Southern Water Authority, Eastleigh (England). Directorate of Resource Planning.
For primary bibliographic entry see Field 4B.
W79-09988

CANAL SEEPAGE WITH BOUNDARY AT FINITE DEPTH,
Rookee Univ. (India). Water Resources Development Training.
For primary bibliographic entry see Field 2G.
W79-09990

2G. Water In Soils

INTAKE CHARACTERISTICS OF IRRIGATION FURROWS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
D. D. Fangmeier, and M. K. Ramsey.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 4, p 696-700, 705, August 20, 1978. 3 fig, 3 tab, 5 ref.

Descriptors: Infiltration, Intakes, *Furrow irrigation, *Infiltration rates, Estimating equations.

Seven irrigations were conducted on precision field furrows. Water volume balances were used to calculate infiltration and intake functions. The Philip equation provided a slightly better estimate of infiltration than the Kostiakov equation, but the constants in the Philip equation were more difficult to obtain. The intake rate appeared to be linearly related to the wetted perimeter for the irrigation conducted. (Skogerboe-Colorado State)
W79-09909

NITROGEN AND CHLORIDE LEACHING IN A SANDY FIELD PLOT,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
D. R. Cameron, C. G. Kowalenko, and K. C. Ivarson.
Soil Science, Vol. 126, No. 3, p 174-180, September, 1978. 3 fig, 2 tab, 15 ref.

Descriptors: *Nitrogen, *Chloride, *Leaching, Leachate, Environmental sanitation, Denitrification, Nitrates.

In field experiments conducted on a well-drained, sandy soil, 59 and 99 percent of the added chloride was lost by leaching from the 0-75-cm layer by the end of October in 1975 and 1976, respectively. Chloride losses were proportional to total precipitation. The average spring-to-fall rates of N losses for 1975 and 1976 were 0.65 and 1.45 kg N/ha/day, and were directly proportional to N fertilization rates of 120 and 255 kg/ha, respectively. NO3-N and Cl tended to show similar distribution patterns in the profile, and ratios of Cl to NO3-N indicated predominant leaching rather than denitrification losses. N and Cl losses appeared to be associated with irregular, diffuse bulges, rather than with distinct peaks of solute moving steadily downward. (Skogerboe-Colorado State)
W79-09911

SOIL WATER CONTENT AND TEMPERATURE AS FACTORS IN THE VOLATILE LOSS OF APPLIED MERCURY (II) FROM SOILS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 2K.
W79-09916

TIME OF SPREAD RELATIONSHIP IN IRRIGATION CHECK BASINS,
Guelph Univ. (Ontario).
T. C. Sharma.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 3, p 505-509, June 20, 1978. 3 fig, 4 tab, 5 ref.

Descriptors: Basins, *Irrigation, Dimensional analysis, Infiltration, Estimating equations, *Water spreading.

Time of spread of water in a check basin is of vital importance for designing efficient check basin irrigation system. The analytical solutions for determination of time of spread tend to be quite complex and impractical due to the unsteady spatially varied nature of flow on nearly zero slopes of the land. In this study, the technique of dimensional analysis was used to derive time of spread relationships in check basins. (Skogerboe-Colorado State)
W79-09917

INFILTRATION OF LIQUID DAIRY MANURE INTO SOIL,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5E.
W79-09965

WATER REQUIREMENTS AND WATER TABLE VARIATIONS FOR A CONTROLLED AND REVERSIBLE DRAINAGE SYSTEM,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
C. W. Doty, and J. E. Parsons.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 532-536 and 539, May-June 1979. 8 fig, 2 tab, 11 ref.

Descriptors: *Drainage, *Irrigation, *Water table, Variability, Fluctuations, Soil water, Storage, Water requirements, Crops, Crop production, Corn(Field), Tiles, Tile drains, Tile drainage, Pumping, Agriculture, Reversible drainage systems, Water mounds.

A water mound can be built by controlling the head above the tile outlet. The approximate shape of the mound above three tile spacings, the water requirements, head requirements, and the yield relations to tile depths and spacings were presented. (Sims-ISWS)
W79-09966

SUBSIDENCE RELATED TO LAND USE IN EVERGLADES AGRICULTURAL AREA,
Agricultural Research and Education Center, Belle Glade, FL.
For primary bibliographic entry see Field 4A.
W79-09968

ENGINEERING PROBLEMS ASSOCIATED WITH EXPANSIVE CLAYS FROM ROMANIA,
Institutul de Constructii din Bucuresti (Romania). Dept. of Soil Mechanics and Foundation Engineering.
M. E. Popescu.
Engineering Geology, Vol. 14, No. 1, p 43-53, June 1979. 6 fig, 2 tab, 16 ref.

Descriptors: *Expansive clays, *Soil physical properties, *Shrinkage, *Soil mechanics, Clays, Moisture content, Soil structure, Consolidation, Voids, Soil moisture, Anisotropy, Laboratory tests, Analysis, Foreign research, Soil tests, Foreign countries, *Romania.

Engineering problems associated with expansive clay formations, which have a large swelling and shrinking potential, exist in different regions of Romania. In the general framework of the study of the behavior of expansive clays, this paper described some particular aspects connected with the swelling and shrinkage processes and their engineering effects in Romania. The differences between swelling potential relationships, obtained by two different methods, were presented and discussed. Swelling pressure tests were accomplished using the available standard techniques, as well as a specially developed cell pressure equipment. Attention was drawn to the stages of the shrinkage process as related to soil structure. It was found that, in a general case, there are 3 distinct stages: initial, normal, and residual shrinkage. Laboratory investigations have shown that in soils with an anisotropic structure, the directional variation of shrinkage strains is elliptical in shape, with the maximum shrinkage normal to particle orientation. The engineering aspects of the results were discussed. The paper is thought to be a useful contribution to a better understanding of swelling and shrinking behavior, at least in some of its particular aspects, such as the laboratory measurement of absolute swelling pressure, shrinkage process stages, and the effect of anisotropy on shrinkage of expansive clays. (Humphreys-ISWS)
W79-09972

USE OF FLUORESCENT DYES TO MARK THE PATHWAYS OF SOLUTE MOVEMENT THROUGH SOILS UNDER LEACHING CONDITIONS: 1. LABORATORY EXPERIMENTS,
Reading Univ. (England). Dept. of Soil Science.
U. Omoti, and A. Wild.
Soil Science, Vol. 128, No. 1, p 28-33, July 1979. 3 fig, 3 tab, 16 ref.

Descriptors: *Solutes, *Soil water, *Soil water movement, Laboratory tests, Dyes, Fluorescent dye, Photography, Ultraviolet radiation, Chlorides, Adsorption, Soils, Soil science, Pyranine, Fluorescein.

A technique was described to identify the pathways of solute movement down columns of sieved soil aggregates using fluorescent dyes and recording their presence by ultraviolet photography. Pyranine was found to be the most useful dye for short-term laboratory experiments because of its high fluorescence and comparatively low adsorption coefficient. The uneven distribution of pyranine across the horizontal faces of successive soil sections, as shown by ultraviolet photography, indicated that the solute moved preferentially in some parts of the column. The technique was found to be of value in checking the uniform packing of columns of soil aggregates and to have potential use under field conditions. (Sims-ISWS)
W79-09976

COMPUTER SIMULATION MODEL FOR PREDICTING SOIL WATER CONTENT PROFILES,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
R. de Jong, and D. R. Cameron.
Soil Science, Vol. 128, No. 1, p 41-48, July 1979. 7 fig, 1 tab, 17 ref.

Descriptors: *Soil water, *Soil water movement, *Model studies, Mathematical models, Computer models, Hydraulic conductivity, Diffusivity, Evapotranspiration, Evaporation, Moisture content, Rainfall, Crops, Vegetation, Vegetation effects,

On-site investigations, Sampling, Soil-water-plant relationships, Soils, Soil science.

A simulation model describing water movement through field-cropped soils was developed. The soil water flow equation, which included a root extraction term, was approximated using a finite difference technique. Hydraulic conductivity (K) and diffusivity (D) functions were calculated by using the Millinton-Quirk technique. The chosen boundary conditions, rainfall, evapotranspiration, and a fluctuating water table approximated those existing in the field. Submodels to calculate interception, evaporation, and transpiration were included in the model. Model predictions were in good agreement with field data from a fairly uniform soil. On a soil containing discontinuous clay varves, the predictions were not satisfactory when the original calculated K and D functions were used. Predicted and measured water content profiles were in closer agreement when the K and D functions were modified within the limits of the measured moisture retention curve data. (Sims-ISWS)
W79-09977

SIMULATION OF INFILTRATION FROM A CONTINUOUS AND AN INTERMITTENT SUBSURFACE SOURCE,
Cook Coll., New Brunswick, NJ.
W. J. Busscher.
Soil Science, Vol. 128, No. 1, p 49-55, July 1979. 8 fig, 7 ref.

Descriptors: *Infiltration, *Subsurface flow, *Unsteady flow, *Model studies, Mathematical models, Computer models, Soil water, Soil water movement, Flow, Hydraulic conductivity, Soils, Subsurface waters, Intermittent water sources, Piezometric potential, Matric potential.

Infiltration from an intermittently flowing subsurface source of water was compared via numerical methods with a continuous source. Though the intermittent source was flowing for only 50% of the time on a 4-h cycle, its cumulative infiltration was 80% of that for the continuous source at 175 h after the initiation of flow. Furthermore, this latter percentage increased with time. This high value was caused by redistribution during no-flow conditions, which increased the matric potential gradient near the source causing a rapid influx of water when flow was reinitiated. (Sims-ISWS)
W79-09978

NITROGEN-ISOTOPE RATIO STUDIES OF SOILS AND GROUNDWATER NITRATE FROM ALLUVIAL FAN AQUIFERS IN TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 5B.
W79-09983

AN ANALYTICAL SOLUTION FOR THE TRANSIENT DITCH DRAINAGE PROBLEM,
Center for Water Resources Development and Management, Trivandrum (India).
P. Basak.
Journal of Hydrology, Vol. 41, No. 3/4, p 377-382, May 1979. 3 fig, 4 ref.

Descriptors: *Drainage, *Ditches, *Water table, Equations, Recharge, Groundwater, Soil water, Hydraulics, Seasonal, Water balance, *Boussinesq equation, Transient water table.

The problem of the transient water table between two parallel ditches which are subject to a uniform recharge was analytically investigated. A closed-form solution of the governing nonlinear partial differential equation was obtained for the first time and was reported in this paper. The solution gives the transient water table profile at any nondimensional recharge rate P. The drainage spacing formula in the presence of recharge is consequently derived. In the absence of recharge, the drainage spacing expression reduces to the known exact solution owing to Boussinesq with a modified constant. (Lee-ISWS)
W79-09984

INFILTRATION AS INFLUENCED BY IRRIGATION WATER QUALITY,
Science and Education Administration, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 5C.
W79-09989

CANAL SEEPAGE WITH BOUNDARY AT FINITE DEPTH,
Rookee Univ. (India). Water Resources Development Training.
H. D. Sharma, and A. S. Chawla.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14715, p 877-897, July 1979. 14 fig, 15 ref, 1 append.

Descriptors: *Seepage, *Canals, *Drainage, Hydraulics, Phreatic lines, Channels, Equations, Mapping, Discharge(Water), Groundwater, Soil water, *Conformal mapping, Phreatic surface.

Closed-form solution for the problem of seepage from channels in homogeneous and isotropic material extending up to finite depth with drainages at a finite distance from the canal and at finite depth has been obtained by the use of conformal mapping. Equations for seepage discharge and the shape of the phreatic line were given. The analysis indicated that the phreatic surface rises with decrease in the depth of impervious layer and increase in the width of the channel and the drainage distance. For larger values of T/n, the phreatic surface was seen to curve continuously and is S-shaped. With a decrease in the value of T/n, the curvature of the phreatic surface is reduced. It also was seen that the seepage discharge increases with an increase in the depth of the pervious stratum and approaches the value for the case of a canal with depth of pervious stratum extending to infinity. (Lee-ISWS)
W79-09990

FERTILIZER NITROGEN DISTRIBUTION UNDER IRRIGATION BETWEEN SOIL, PLANT, AND AQUIFER,
Minnesota Univ., St. Paul.
For primary bibliographic entry see Field 4B.
W79-10024

SALINITY PROFILES AND LEACHING FRACTIONS FOR SLOWLY PERMEABLE IRRIGATED FIELD SOILS,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
W. E. Lonkerd, C. F. Ehlig, and T. J. Donovan.
Journal of the Soil Science Society of America, Vol. 43, No. 2, p 287-289, Mar.-Apr., 1979, 2 fig, 1 tab, 6 ref.

Descriptors: *Leaching, *Saline soils, *Permeability, *Crop response, *Irrigation efficiency, *Soil water movement, Soil management, Soil water, Crop production, Irrigation effects, Imperial Valley, California, Horticultural crops, Agronomic crops, Root zone.

Although it is necessary to periodically leach accumulated salts within the root zone of irrigated crops, there is only limited information available on the actual magnitude and variability of leaching fractions in commercial crop fields of low water intake soils. Accordingly, the purpose of the present study was to determine the soil salinity status and leaching fractions on four representative Imperial Valley soils planted to alfalfa, cotton, lettuce, sugarbeets, and wheat. Soils were sampled in 33 alfalfa (Medicago sativa L.), 13 cotton (Gossypium hirsutum L.), 19 lettuce (Lactuca sativa L.), 17 sugarbeet (Beta vulgaris L.), and 21 wheat (Triticum aestivum L.) fields in 30 cm increments to a 150 cm depth. Accumulated data were tabulated to show the range and median values of ECe, CLe, and LF below the plant root zones. Assuming a desirable leaching fraction of 15-20% for lettuce and 5-10% for alfalfa, cotton, sugarbeets, and wheat, results for nearly all soil-crop combinations indicated that leaching fractions ranged from insufficient or marginal in Imperial and Meloland soils planted to all crops, to excessive in Holtville and Indio soils planted to lettuce, sugarbeets, and wheat. It is hoped that this information will be used in the development of appropriate management practices to increase water use efficiency in irrigation while avoiding the consequences of excessive salinity on crop yield. (Tickes-Arizona)
W79-10075

2H. Lakes

DISTRIBUTION PATTERNS AND POPULATION DYNAMICS OF POLYPHEMUS PEDICULUS (L.) (CRUSTACEA, CLADOCERA) IN A SMALL NEW ENGLAND LAKE,
New Hampshire Univ., Durham.
M. T. Mattson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 486, Price codes: A09 in paper copy, A01 in microfiche. Doctor of Philosophy Dissertation, 1979. 173 p, 26 fig, 9 tab, 107 ref. OWRT A-041-NH (1), 14-31-0001-5029.

Descriptors: *Aquatic populations, *Distribution patterns, *Crustaceans, Ponds, Migration, On-site investigations, Diel migration, Barrington(NH), *Polyphemus pediculus.

A stratified random sampling design was evaluated in its ability to quantify spatial and seasonal changes in abundance of the predatory cladoceran, Polyphemus pediculus (L.). A whole-lake stratified design with sample units consisting of eighty-four 20-meter Clarke-Bumpus tows was used to quantify seasonal abundance and reveal changes in horizontal distribution (patchiness) of the Polyphemus population in Stonehouse Pond, Barrington, N.H., during 1975 and 1976. Seasonal abundance was typified by an exponential rise to a spring maximum, followed by an exponential decline to a summer plateau. A slight secondary peak occurred in August of each year, and abundance declined to zero in late fall. Two sexual (at the spring abundance maximum and in mid-fall) and three parthenogenetic (early spring, a long summer period, and late fall) periods of reproduction occurred. Gamogenetic brood size was significantly smaller in the spring (2.17 + over - 0.46) than in the fall (3.96 + over - 0.23). Population growth rates were characterized primarily by changes in natality associated with these alternating reproductive modes. The timing of gamogenesis with the spring abundance maximum resulted in greater resting egg production in the spring than in the fall. In both sexual periods, resting egg production was large and occasionally the dominant mode of reproduction. In the spring and fall, the total Polyphemus population was found close to shore, while in the summer it was primarily limnetic in distribution. However, mean densities were usually greater and patches were typically found in the littoral zone.
W79-09836

DISTRIBUTION OF PHYTOPLANKTON IN LOUISIANA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
V. W. Lambou, F. A. Morris, M. K. Morris, W. D. Taylor, and L. R. Williams.
Report No. EPA-600/3-79-064, Ecological Research Series, June 1979. 74 p, 40 tab, 12 ref, 2 append.

Descriptors: *Phytoplankton, *Louisiana, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae.

The species and abundance of phytoplankton in 19 Louisiana lakes sampled during the National Eutrophication Survey in the spring, summer, and fall of 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine relationships between algal characteristics and trophic status of lakes. All lakes sampled: (1) were impacted by one or more municipal sewage treatment plant outfalls, (2) were 40 hectares or larger, and (3) had a mean hydraulic retention rate of at

least 30 days. At each site, a depth-integrated phytoplankton sample was taken. Normally, a lake was sampled three times during the year. Samples were concentrated and examined by microscope. A general phytoplankton list for all of the lakes is provided. All of the phytoplankton data collected are summarized by lake including an alphabetical phytoplankton species list with concentrations for individual species given by sampling date. Results from the application of several indices, (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are also presented for each of the 19 lakes. (Seigler-IPA)
W79-10026

DISTRIBUTION OF PHYTOPLANKTON IN SOUTH DAKOTA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
S. C. Hern, V. W. Lambou, F. A. Morris, M. K. Morris, and W. D. Taylor.
Report No. EPA-600/3-79-069, Ecological Research Series, June 1979. 88 p, 66 tab, 12 ref, 2 append.

Descriptors: *Phytoplankton, *South Dakota, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae.

The species and abundance of phytoplankton in 31 South Dakota lakes sampled during the National Eutrophication Survey in the spring, summer, and fall of 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine relationships between algal characteristics and trophic status of lakes. The screening and selection of lakes to be sampled strongly emphasized lakes with actual or potential accelerated eutrophication problems. As a result, all the sampled lakes: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger in size; and (3) had a mean hydraulic retention time of at least 30 days. At each sampling site, a depth-integrated phytoplankton sample was taken. Normally, a lake was sampled three times during the year. Permanent slides were prepared from concentrated samples and examined by microscopic techniques. A general phytoplankton list for all the lakes is provided. All of the phytoplankton data collected are summarized by lake including an alphabetical phytoplankton species list with concentration for individual species given by sampling data. Results from the application of several indices, (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are also presented for each of the 31 lakes. (Siegler-IPA)
W79-10027

2I. Water In Plants

MAGNESIUM UPTAKE FROM EXCHANGEABLE AND NONEXCHANGEABLE SOURCES IN SOILS AS MEASURED BY INTENSIVE CROPPING,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
D. R. Christenson, and E. C. Doll.
Soil Science, Vol. 126, No. 3, p 166-168, September, 1978. 4 tab, 6 ref.

Descriptors: *Magnesium, Nutrients, Mineralogy, Greenhouses, *Nutrient removal, Oats, Michigan, Plant growth.

Several soils were cropped with four consecutive crops of oats (Avena sativa, 'Garry') in the greenhouse. Changes in exchangeable Mg levels were used to indicate uptake from that source. The remainder of the uptake was attributed to the nonexchangeable source. Total uptake by the four crops did not appear to be related to total Mg level in the soil, percent clay in the soil, or exchangeable Mg level. Mg availability did appear to be related to the mineralogy of the medium clay fraction. (Skogerboe-Colorado State)
W79-09908

RESPONSE OF NATIVE GRASSLAND LEGUMES TO WATER AND NITROGEN TREATMENTS,
Colorado State Univ., Fort Collins. Natural Resource Ecology Lab.
W. K. Lauenroth, and J. L. Dodd.
Journal of Range Management, Vol. 32, No. 4, p 292-294, July 1979. 2 fig, 1 tab, 15 ref.

Descriptors: *Crop response, *Nitrogen fixation, *Legumes, *Moisture availability, *Nutrient requirements, *Nitrogen cycle, *Environmental effects, *Soil-water-plant relationships, Grasslands, Productivity, Biomass, Great Plains.

Although grassland nitrogen-fixing plants occupy an important position in the nitrogen cycle of the semiarid Great Plains grasslands, little has been known about the ecology or functional significance of these native legumes. With the purpose of providing basic phytosociological data for legumes under ambient environmental conditions, native shortgrass prairie legumes were subjected to the experimental manipulation of soil water and mineral nitrogen availability at the Pawnee experimental site 61 Km northwest of Fort Collins, Colorado. In this experiment, initiated in 1970, a factorial design with two water and two nitrogen treatments was employed on two sets of four one-ha plots consisting of a control, water, nitrogen, and water-plus-nitrogen treatments. A total of seven species of legumes was encountered during the study period, the largest number on the water-treated plots where legume densities increased each year of the study and in 1974 were approximately 30 times greater than the control. Above-ground biomass and density measurements substantiated the success of legumes under conditions of increased water availability presumably because of the more favorable conditions for nitrogen fixation and increased competitive advantage under nitrogen deficient conditions. (Tickes-Arizona)
W79-10071

2J. Erosion and Sedimentation

WATER QUALITY CHARACTERISTICS OF THE HORSE CREEK WATERSHEDS IN NORTH CENTRAL IDAHO,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 2A.
W79-09838

CONSEQUENCES OF HARVESTING AND SITE PREPARATION IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 5A.
W79-09878

APPLICATION OF INFINITE SLOPE ANALYSIS TO SUBAQUEOUS SEDIMENT INSTABILITY, MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W79-09970

A DIRECT OBSERVATION TECHNIQUE FOR THE STUDY OF MICROORGANISMS IN SEDIMENT SAMPLES,
Waterloo Univ. (Ontario). Dept. of Biology.
D. R. Polonenko, C. I. Mayfield, and W. E. Inniss.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 237-245, February 1979. 3 fig, 3 tab, 14 ref.

Descriptors: *Microorganisms, *Sediments, *Microscopy, Laboratory tests, Microbiology, Analytical techniques, Nutrients, Toxins, Biology, Lakes, Lake sediments.

A technique was described for the incubation of sediment samples under controlled conditions and the examination of the sediment by direct microscopy after percolation with a fluorescent stain--the ammonium salt of 8-anilino-1-naphthalenesulfonic acid. The incubation chamber employed enabled the sediment sample to be treated by percolation with nutrients or with toxic chemicals. The response of the sediment microorganisms to these amendments could be analyzed using pattern determination statistics or direct counts at intervals during incubation. (Sims-ISWS)
W79-09982

2K. Chemical Processes

SOME EFFECTS OF UREA FERTILIZATION ON A FORESTED WATERSHED IN WEST VIRGINIA,
Northeastern Forest Experiment Station, Parsons, WV.
J. H. Patric, and D. W. Smith.
In: Central Hardwood Forest Conference, Proceedings of the Second Meeting, Purdue University, P. E. Pope, editor, p 210-227, 1978. 4 tab, 17 ref.

Descriptors: Ammonia, Calcium, Forestry, Interception, Magnesium, Nitrates, Phosphates, Potassium, Rainfall, *Small watersheds, Specific conductance, Water yield, *Urea, Central Appalachians, *Forest fertilization, West Virginia.

A 75-acre watershed on the Fernow Experimental Forest, near Parsons in West Virginia, was fertilized in May 1971 with 500 pounds of urea per acre. It had a dense stand of 12-year-old hardwood sprouts and seedlings, natural regrowth after clearcutting in 1958. The effects on soil-plant-water relations have been observed since fertilization. Soil content of total nitrogen, phosphorus, potassium, calcium, and magnesium was unchanged except for nitrogen, which was significantly lower on southslope soils during 1972 and 1973. Analyses of yellow-poplar buds for the same nutrients showed significantly increased content of nitrogen but only in 1972. A significant streamflow decrease of 1.23 inches accompanied a throughfall decrease of 0.89 inch in 1972. There was no change in stream pH. Increased specific conductance after fertilization reflected temporarily increased stream content of calcium (3 years), nitrate (2 years) and of magnesium and sodium (1 year). Sulfate content of the stream decreased, but only in 1971. The disposition of urea-N is reckoned as about 20 percent lost to streamflow, up to 50 percent volatilized, 5 percent remaining in the standing phytomass, and the balance probably mobile in the soil and associated organic matter. (Forest Service)
W79-09847

CATION EXCHANGE EQUILIBRIA IN FLORIDA AND INDIANA HISTOSOLS,
Purdue Univ., Lafayette, IN.
V. C. Baligar, S. A. Barber, and D. L. Myhre.
Soil Science, Vol. 125, No. 2, p 109-117, August, 1978. 2 fig, 4 tab, 31 ref, 8 equ.

Descriptors: *Cation exchange, Organic soils, Cation adsorption, Potassium, Isotherms, Soil chemistry, Florida, Indiana.

Ion exchange equilibria have been investigated in mineral soils, but little information is available for organic soils. This investigation was undertaken to characterize the cation selectivity of differing histosols and to determine a suitable cation exchange equation to express the ion selectivity in these soils. Four histosols were incubated for 3 weeks with 5 levels of K and Rb. At the end of incubation, ions in soil solution and on the adsorbed phase were determined. All soils had a greater fraction of Ca in the exchange phase than in solution, whereas with Mg, Na, K, and Rb, the reverse occurred. Increasing K and Rb saturation was related to an increase in selectivity coefficient for Rb-K. On the Pahokee muck soils, Rb was adsorbed more tightly than K, where the amount of Rb added exceeded 1.0 me/100 g of soil. On the Edwards muck soil, Rb was adsorbed preferentially to K at all levels. Magnesium was adsorbed preferentially to Ca on the Edwards muck soil, but not on the Pahokee soils. Selectivity coefficients for K-Ca were calculated using the Kerr, Gapon, Krishnamoorthy and Overstreet, Vanselow, and Scheffer and Ulrich equations. In all but the Scheffer and Ulrich equation, the selectivity coefficient decreased as K and

Rb were increased. In the latter it increased. No equation satisfactorily described the system. (Skogerboe-Colorado State)
W79-09912

SOIL WATER CONTENT AND TEMPERATURE AS FACTORS IN THE VOLATILE LOSS OF APPLIED MERCURY (II) FROM SOILS,
Oregon State Univ., Corvallis.
E. R. Landa.
Soil Science, Vol. 126, No. 1, p 44-48, July, 1978. 2 fig, 1 tab, 16 ref.

Descriptors: *Mercury, Volatility, Soil contamination, *Moisture content, *Soil temperature, Pollutant identification, Water pollution sources.

Five surface soils from southeastern Montana were studied to determine the effects of soil water content and temperature on the volatile loss of applied divalent inorganic mercury. Soils were amended to 1 ppm Hg as 203 Hg-Hg(NO3)2. The water content studies involved soil samples at room temperature (18-25 C), either allowed to air-dry or maintained near the 1/3-bar or the 80 percent saturated moisture levels. The temperature studies involved samples at the 1/3-bar moisture level maintained at either 10 C, room temperature, or 35 C. Residual Hg content was monitored for 5-7 weeks. Hg losses were higher at the 1/3-bar moisture content than at air-dryness or 80 percent saturation. At 35 C the initial Hg loss rate was accelerated with respect to room temperature, while at 10 C, losses were considerably reduced. (Skogerboe-Colorado State)
W79-09916

METHODOLOGY OF STUDIES ON CHEMICAL PROCESSES IN WATER RUNOFF FROM ROCK AND SHALLOW SOIL COVER USING RADIOACTIVE TRACERS,
Institutt for Atomenergi, Kjeller (Norway).
J. B. Dahl, C. Qvenild, O. Tollan, N. Christophersen, and H. M. Seip.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 179-190, February 1979. 7 fig, 5 tab, 19 ref.

Descriptors: *Water chemistry, *Runoff, *Simulated rainfall, Soils, Rocks, Weathering, Adsorption, Tracers, Vegetation, Vegetation, Vegetation effects, Tritium, Calcium, Sulfur, Bromine, Isotope studies, On-site investigations, *Norway.

Studies of flow patterns and chemical processes in water runoff from small plots (natural 'fields' with an area of about 5 sq m) have been carried out. Simulated rain containing radioactive tracers, i.e., T (as HTO), Ca (45Ca(2+)), S (35SO4(2-)), and Br (82Br(-)) was distributed with an intensity of about 10 mm/h. Calcium ions are strongly adsorbed by soil or taken up by vegetation in most cases; even on rocks covered only by sparse lichens, the adsorption is considerable. The total Ca concentration in the runoff is, nevertheless, often higher than in the artificial precipitation. Sulphate ions follow T rather closely. However, the ratio of 35SO4(2-) to T concentrations in the runoff may differ somewhat from the value in the precipitation. Ratios above one were found in the experiment on 'barren' rock and during the first stage of the other experiments. (Sims-ISWS)
W79-09980

INTERACTION BETWEEN SIMULATED RAIN AND BARREN ROCK SURFACE,
Norske Skogforsoksvesen, Oslo.
G. Abrahamsen, A. Stuanes, and K. Bjor.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 191-200, February 1979. 6 fig, 2 tab, 14 ref.

Descriptors: *Water chemistry, *Runoff, *Acidic water, *Simulated rainfall, Rocks, Granites, Acidity, Salts, Ions, Cations, Anions, Hydrogen ion concentration, Lichens, On-site investigations, *Norway, Acid rainfall.

During the latter decades extensive fish kills have been observed in the mountainous areas of southernmost Norway. These kills have been attributed to the increased acidity of the river water. The increased acidity is generally assumed to be caused by acid precipitation. However, the relationship between precipitation and runoff quality is very complex. This paper was concerned with the relationship between chemical composition of simulated rain and that of runoff from bare granitic rock, partly covered by lichens. When supplying simulated rain with a pH value of approximately 5, the very first runoff had pH values between 4.1 and 4.3. However, the pH in the runoff increased rapidly and leveled out at values between 4.6 and 4.7. When supplying simulated rain with pH approximately 3.5, the pH in the first runoff varied between 3.8 and 3.6. The pH then gradually decreased to the same values as those in the simulated rain. Runoff from 'rain' with pH 4.3 obtained the same pH value as that of the 'rain'. The pH of the runoff was dependent not only on the rain acidity, but also on its content of neutral salts. (Sims-ISWS)
W79-09981

BORON DISTRIBUTION IN SOILS AND WATERS OF EGYPT,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. A. Elseewi, and A. E. Elmalky.
Soil Science, Vol. 43, No. 2, p 297-300, March-April, 1979. 4 fig, 3 tab, 17 ref.

Descriptors: *Boron, *Chemical analysis, *Water chemistry, *Environmental effects, *Soil physical properties, Salinity, Soil texture, Soil profiles, Nile Delta, Egypt, Toxicity, Hydrogen ion concentration, Sampling.

Boron, which can accumulate to harmful levels in arid and semi-arid regions, has been indicated by preliminary investigations to exist in excessive concentrations in soils and waters in many areas of Egypt. The purpose of the present paper is to present data on the distribution of boron in some Egyptian soils as examples of typical arid zone soils, and to give the relationship between these fractions and some soil parameters such as soil pH, salinity, solid carbonate content, depth and texture. Twenty-six soil profiles from six geographically different sites in the Nile Delta and surrounding deserts were analyzed and sampled at consecutive depths of 0-30, 30-60 and 60-90 cm. Samples of Nile irrigation and drainage water also were collected and analyzed. A summary of physical, chemical and boron analysis of the soil and water samples collected indicated that saturation extract and hot water soluble boron averaged 0.6 mg/ml and 1.3 mg/g respectively, while acid soluble and total boron averaged 10.2 and 113 mg/g. Total boron concentrations were on the average twice as high in clay samples as in sandy soils and decreased by 32% lower than 60 cm in the soil profile. Boron concentrations in Egyptian soils were above the sufficiency level or were similar to or a reasonable multiple of Nile water boron concentrations, indicating that under proper management, boron toxicity can be controlled. (Tickes-Arizona)
W79-10073

2L. Estuaries

THE DISTRIBUTION AND SEASONALITY OF THE BENTHIC AQUATIC MACROPHYTES OF THE PAMLICO RIVER ESTUARY, NORTH CAROLINA,
East Carolina Univ., Greenville, NC. Dept. of Biology.
S. E. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 496, Price codes: A04 in paper copy, A01 in microfiche. M. S. Thesis January 1979. 55 p, 9 fig, 8 tab. OWRT A-077-NC (11), 14-31-0001-5033.

Descriptors: *Benthic flora, *Macrophytes, Seasonal growth, *Submerged plants, Plant distribution, Plant growth, Estuaries, Pamlico River.

The distribution and seasonal dynamics of the submersed vascular plants and macroscopic algae of the Pamlico River estuary, North Carolina, were studied from 7/73-8/74. Plants were restricted mainly to the sandy shallow margins in the upper two-thirds of the estuary with most of the biomass around 1 m depth. The estuary was divided into oligo-, meso- and polyhaline zones based on a rather unstable salinity gradient. In the oligohaline zone macrophyte communities consisted of Vallisneria americana, Potamogeton perfoliatus var. bupleuroides, Najas guadalupensis, and the muskgrasses Chara sp. and Nitella sp.; the mesohaline zone included V. americana, P. perfoliatus and Ruppia maritima; and some sheltered low energy environments of the polyhaline zone had small amounts of R. maritima. Line transects were used to sample biomass and community species composition during the seasonal studies. Salinity varied between 1 and 16 ppt depending on the rate of freshwater discharge from the Tar River, the principal tributary. Water temperature closely paralleled air temperature, ranging between 5 and 30 degrees C. During the summer and early fall, the dominant macrophyte was Vallisneria americana, accounting for 80-90% of the total macrophyte biomass in the estuary. Ruppia maritima was dominant during the low temperatures of the winter months and in regions of high salinity, but at low biomass levels. Maximum biomass was recorded in September and October with minimal biomass occurring in February. Compsopogon coeruleus, a red filamentous algae, appeared in nuisance proportions in the oligo-mesohaline area during early summer; the green algae Cladophora sp. and Enteromorpha sp., reached maximum biomass later in the season. (Kiger-North Carolina)
W79-09834

APPLICATION OF INFINITE SLOPE ANALYSIS TO SUBAQUEOUS SEDIMENT INSTABILITY, MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
D. B. Prior, and J. N. Suhayda.
Engineering Geology, Vol. 14, No. 1, p 1-10, June 1979. 4 fig, 1 tab, 22 ref.

Descriptors: *Deltas, *Mississippi River, *Slope stability, *Beds, Sediments, Pore pressure, Analysis, Analytical techniques, Landslides, Sedimentation, Slopes, Geomorphology, Submarine landslides.

Submarine landslides were described on very low angle slopes (0.5 deg-1.7 deg) in the Mississippi prodelta area and were evaluated using infinite slope analysis. For instability to occur, pore water pressure ratios in excess of hydrostatic pressure and approaching geostatic pressure are needed. These calculated values, based on 3 sets of effective strength parameters and for 2 sediment depths to failure, are in close agreement with measured pore water pressure data from in situ piezometers. Ratios of geostatic pressure as large as 0.986 have been monitored. Mud vents are also indicative of large internal pressures within the sediments, generated by rapid sedimentation, wave perturbation, and biogenic methane. The analysis suggested that the reduction in effective stress may be sufficient to cause failure by gravitational stresses alone. (Humphreys-ISWS)
W79-09970

EXPERIMENTAL CONTROL OF BEACH FACE DYNAMICS BY WATERTABLE PUMPING,
Australian National Univ., Canberra (Australia). Dept. of Geography.
J. Chappell, I. G. Eliot, M. P. Bradshaw, and E. Lonsdale.
Engineering Geology, Vol. 14, No. 1, p 29-41, June 1979. 6 fig, 12 ref.

Descriptors: *Beach erosion, *Deposition(Sediments), *Water table, *Pumping, *Tidal effects, Water level fluctuations, Sand bars, Sedimentation, Beaches, Wells, Model studies, Rip currents, Infiltration, Swash, Backwash, Hele-Shaw models.

The dynamic sediment budget on the intertidal face of sandy surf beaches is influenced by interaction of swash/backwash flows with the beach wa-

tertable. Watertable height variations are coupled to tides and pass into the beach as a slow wave of diminishing amplitude and increasing lag. High-frequency pulses from the onshore wave train also propagate into the beach. The height at which the watertable outcrops on the beach face is affected by antecedent tide and wave history and influences balance of sand deposition and entrainment during swash and backwash. Experimental lowering of the watertable by pumping an array of wells induces sand deposition. Energy expended in pumping is less than 0.3% of the onshore flux in the wave train. (Visocky-ISWS)
W79-09971

DISPERSION IN THE UPPER DELAWARE ESTUARY,
Rutgers - The State Univ., New Brunswick, NJ. Coll. of Engineering.
R. C. Ahlert, R. L. Peskin, R. Vichnevetsky, and F. Henry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 595, Price codes: A02 in paper copy, A01 in microfiche. Final Technical Completion Report for Project A-044-NJ, Water Resources Research Institute, Rutgers University, New Brunswick. 13 pages, June 1979, 1 tab, 10 ref. OWRT A-044-NJ (1), 14-34-0001-9032.

Descriptors: Estuaries, Dispersion, Mathematical models, Hydrology, Fate of pollutants, Mixing, Currents, Convection, Turbulence, Computer models, Pollutant transport.

The final objective of this work was to characterize the scales of transport occurring in the Upper Delaware Estuary (UDE), using simple numerical models. The estuary can be considered quasi-two-dimensional; the depth scale is much smaller than the width and length scales. However, the bottom roughness must be accounted for, as this is the major mechanism for removal of energy from the flow system. A three-channel model was constructed so that some two-dimensional features of estuarine flow could be studied, while retaining the simplicity of the one-dimensional approach. It bacame evident that it was numerically desirable to split the problem into two parts; a hydraulic model and an advection-diffusion, transport model. The hydraulic model output was compared to date published by the USGS. The data consisted of daily average volume flow rates at Trenton and hourly values of tidal elevation for three gauging stations within the test length. The transport model was tested against data taken from USEPA Tech. Report No. 62 (1978). The data was for a dye study performed in 1974 by USEPA at the Northeastern Philadelphia Wastewater Treatment Plant. The hydraulic model also predicted the existence of large-scale horizontal circulations. These intratidal motions would enhance the mixing of pollutants across the estuary. It is assumed these lateral motions are largely a product of changes in estuary geometry, with downstream distance. The longitudinal dispersion parameter is usually modeled using the depth as the characteristic length scale.
W79-10021

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PRETREATMENT OF SEAWATER FOR REVERSE OSMOSIS PROCESSES: 1976,
Permutit Co., Princeton, NJ.
A. C. Epstein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 509, Price codes: A08 in paper copy, A01 in microfiche. Report proposed for Office of Water Research and Technology (1979) 106 p, 27 fig, 18 tab, 21 ref, 7 append. OWRT (no. 3242)(1), 14-30-3242.

Descriptors: *Desalination, *Membrane processes, *Reverse osmosis, Seawater, Water treatment, Seawater pretreatment, Spiral wound membrane, Thin film composite membranes, Hollow fiber polyamide membrane, Wrightsville Beach, NC.

A field test program was conducted in 1976 (at the Office of Water Research and Technology's Wrightsville Beach Test Facility, Wrightsville Beach, N.C.) of three seawater pretreatment systems which precede reverse osmosis systems. The three pretreatment systems tested were: (1) The OWRT's so-called baseline system which consisted of sand filtration followed by manganese zeolite filtration followed by cartridge filtration. A carbon filter was also included for chlorine removal ahead of the hollow fiber polyamide membrane. (2) A coagulation pretreatment system which consisted of an upflow sludge blanket precipitator followed by a polishing filter and a cartridge filter. A carbon filter was also included in this system for removal of chlorine ahead of the hollow fiber polyamide membrane. (3) In-line coagulation performed ahead of the base-line pretreatment system. The feed to all three systems was chlorinated/microscreened seawater. The pretreated effluent from systems (1) and (2) was used as feed to either a spiral wound thin film composite membrane or a hollow fiber polyamide membrane. Reverse osmosis performance was not evaluated on in-line coagulated water. Systems (2) and (3) provided water with acceptable plugging factors for feeding reverse osmosis systems; system (1) did not. The economics of the three pretreatment systems (in 1976 costs) were determined for a flow rate of 4 million gallons per day. (Easton-OWRT)
W79-09831

DEVELOPMENT OF DRY PROCESS MICROPOROUS POLYSULFONE SUPPORTS FOR ULTRATHIN FILM COMPOSITES,
Chemical Systems, Inc., Tustin, CA.
R. E. Kesting.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 488, Price codes: A03 in paper copy, A01 in microfiche. Final Report prepared for the Office of Water Research and Technology, July 15, 1978-July 15, 1979. 31 p, 2 fig, 4 tab, 24 ref. OWRT (no. 8537)(1), 14-34-0001-8527.

Descriptors: *Membranes, *Films, *Thin films, Permselective membranes, Membrane processes, Wettability, Evaporation control, Porosity, Chemistry, Cellulose, Castings, Viscosity, Desalination, Reverse osmosis, Polysulfone, Polybutylene terephthalate, Dry process.

Ultrathin film composite (UTF) membranes are skinned membranes consisting of thin dense skin and a thick porous substructure. UTF origins in integrally skinned (asymetric) membranes are traced and different types of UTF membranes are described. A dry process microporous support of polybutylene terephthalate (P13T) was developed. It appears to be superior to wet process polysulfone membranes because: (1) PBT membranes are more solvent resistant, (2) PBT membranes are wet-dry reversible due to traces of polyvinylalcohol (PVA), (3) PBT membranes solvent cast onto polyethylene terephthalate (PET) forms an integral bond and cannot be removed inadvertently during handling or operation, and (4) PBT membranes have the optimum high density of 0.1 millimicron pores. The best results were obtained with PBT (6 PRO Eastman) 5g, polyvinyl alcohol (Gelvatol 20-30 Monsanto) 5g, HFIP 90g. This solution was cast 0.02 in. thick onto Eaton-Dikeman 3381 PET nonwoven fabric to yield a support membrane 0.002 in. thick. This PBT membrane appears to be ideal for further development as a UTF support material. A second accomplishment was the development of a one step dry process for casting PS membranes. (Seigler-IPA)
W79-09839

LONG TERM EXPERIMENTS ON SEA WATER DESALINATION AT THE CHIGASAKI LABORATORY,
Water Reuse Promotion Center, Tokyo (Japan).
Y. Kunisada, and Y. Murayama.
Desalination, Vol. 27, No. 3, p 333-344, December 1978. 10 fig, 1 tab, 2 ref.

Descriptors: *Sea water, *Desalination, *Reverse osmosis, *Performance, *Domestic modules, Long-term planning, Desalination plants, Hollow-fiber module, Tubular module, Spiral-wound module, Membrane durability, Japan, Stability, Permeability, Pretreatment.

The technology of producing fresh water from sea water by the reverse osmosis (RO) process has been developed since 1974 under the supervision of the Ministry of International Trade and Industry. Highly satisfactory and stable performances have been recorded for the two-stage desalination process using RO modules developed in Japan. Durability of the membranes under testing is expected to last more than three years. The quality of the product water can be kept below TDS 200 ppm that is suitable for potable consumption. Construction of a demonstration plant of 500 cu m/day using domestic modules is now being planned. (Bell-Graf--Cornell)
W79-09871

ENGINEERING MANAGEMENT OF NUCLEAR DESALINATION PLANTS--A CASE STUDY, SAUDI ARABIA,
Iowa State Univ., Ames. Engineering Research Inst.
A. F. Abdul-Fattah, and A. A. Husseiny.
Desalination, Vol. 27, No. 3, p 283-331, December 1978. 15 fig, 16 tab, 37 ref.

Descriptors: *Desalination plants, *Engineering management, *Nuclear energy, *Powerplants, *Organization, *Manpower, *Saudi Arabia, Projects, Programs, Planning, Capital, Staffing, Non-nuclear countries, Decentralization.

Engineering management and manpower aspects of potential nuclear desalination projects in non-nuclear countries are considered herein with emphasis on safety and quality assurance. Detailed investigation is made of manpower and staffing requirements of dual-purpose nuclear power and desalination plants. Organization and management of typical overall nuclear programs and individual plants are studied to provide specific recommendations of procedures compatible with countries having little or modest industrial activity. Saudi Arabia was selected as a specific case for this study; however, the results apply generally to countries at the same industrial development level. The case of Saudi Arabia is of interest due to the peculiarities of a shortage in human capital and a lack of industries necessary to support desalination and nuclear energy activities. A critical review is made of organization and management models which have been used in business, industry, and government. Examined is the viability of the following models for implementation of nuclear energy projects involving electrical power generation and saline water conversion in non-nuclear countries: bureaucratic model; classical model; semi-classical model: neoclassical concepts; decision-making model; and modern management model. (Bell-Graf--Cornell)
W79-09872

THE WORLD'S FIRST LARGE SEAWATER REVERSE OSMOSIS DESALINATION PLANT, AT JEDDAH, KINGDOM OF SAUDI ARABIA,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
A. Al-Gholaikah, N. El-Ramly, I. Jamjoom, and R. Seaton.
Desalination, Vol. 27, No. 3, p 215-231, December 1978. 4 fig, 4 tab.

Descriptors: *Desalination, *Desalination plants, *Reverse osmosis, *Jeddah(Saudi Arabia), Design, Evaluation, Capital costs, Installations, Logistics, Operation and maintenance, Costs, Distillation, Delivery times, Multiflash distillation, Sea water.

Traditionally, coastal urban centers in arid areas have had to rely on distillation for the desalting of seawater. But there is now a new alternative, as exemplified by the current installation of a large reverse osmosis plant to desalt highly saline Red Sea water to supply municipal water needs at Jeddah, Saudi Arabia. The Saline Water Conver-

sion Corporation of the Kingdom of Saudi Arabia awarded a competitively-bid contract to Fluid Systems Division of UOP Inc. for the design, fabrication, construction and two-year operation and maintenance of a seawater reverse osmosis desalting plant with a production capacity of 12,000 cu m/day. This paper presents a comprehensive review and description of the design, logistics and installation aspects of the plant together with an evaluation of delivery times and capital and operating costs of reverse osmosis vis-a-vis multiflash distillation for seawater desalination. (Bell-Graf--Cornell)
W79-09873

LAS PALMAS PHASE II DESALINATION PLANT IN THE CANARY ISLANDS (SPAIN),
Babcock and Wilcox Expanola S.A., Madrid (Spain).
J. Guzman.
Desalination, Vol. 27, No. 2, p 175-187, November 1978. 5 fig.

Descriptors: *Desalination plants, *Canary Islands(Spain), Projects, Desalination, Economics, Water costs, Corrosion control, Scale control, Water supply, Construction, Evaporators, Production costs, Amortization costs.

The principal features of the desalination plant Las Palmas Phase II in the Canary Islands are described. Two plants are of the multi-stage flash cross-flow acid-dosing type with a nominal capacity of 9000 cu m/day each. The steam supply is provided by the existing power station. A description of the criteria adopted for the prevention of corrosion is mentioned and a review is given of the main materials used. The economics of the cost of water from this plant are considered. (Bell-Graf--Cornell)
W79-09874

WATER FACTORY 21 DESIGN AND OPERATING DATA,
Orange County Water District, Fountain Valley, CA.
For primary bibliographic entry see Field 5D.
W79-09961

PROCESS FOR SCALE CONTROL USING MIXTURES OF POLYCATIONIC AND POLYANIONIC POLYMERS,
American Cyanamid Co., Samford, CT. (Assignee).
R. M. Goodman.
U.S. Patent No. 4,147,627, 6 p, 10 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 238, April 3, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Desalination processes, Scaling, Saline water, Evaporators, Desalination apparatus, Magnesium hydroxide.

Although evaporative desalination units are potentially efficient in the desalination of sea waters and waters of high salt contents, the rapid formation of magnesium scaling or sludging reduces efficiency, necessitating shut-down and scale or sludge removal from the desalination units. It has been found that magnesium hydroxide scale formation in evaporative desalination units is inhibited by adding to the saline water being processed a mixture of certain polycationic and polyanionic polymers. (Sinha-OEIS)
W79-10072

3B. Water Yield Improvement

MINIMIZING THE SALT BURDEN OF IRRIGATION DRAINAGE WATER IN THE PECOS VALLEY OF NEW MEXICO.
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
J. G. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 516, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 56 p, 11 fig, 12 tab, 30 ref. OWRT A-056-NMEX (1), 14-34-0001-7066.

Descriptors: *Irrigation practices, Management, *Leaching, Salt balance, Drainage water, Soil management, Salts, Leachate, Pecos River Valley.

Pecos River water has been reported to be ideally suited for minimized leaching. Results of this study appear to support these findings. Reducing leaching fractions decreased irrigation water requirement and lowered the salt burden of drainage water. These reductions were effected without detrimentally affecting soil chemical and physical properties and without reducing crop yields. Soil and drainage data appeared to validate the applicability of the U.S. Salinity Laboratory's chemical computer model to Pecos Valley conditions.
W79-09837

CAN FOREST LAND PRODUCE WOOD, RECREATION, AND HIGH QUALITY WATER TOO,
Northeastern Forest Experiment Station, Parsons, WV.
For primary bibliographic entry see Field 4C.
W79-09851

STATE OF THE ART IN MANAGING WATER RESOURCES ON FOREST LAND,
Southeastern Forest Experiment Station, Franklin, NC. Coweeta Hydrologic Lab.
J. E. Douglass.
In: Proceedings Western North Carolina Research-Resource Management Conference, September 14-16, 1977, Asheville, North Carolina, p 56-60, 1977. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina. 16 ref.

Descriptors: *Water supply, *Forested watershed, *Water quality, *Flow duration, *Flow augmentation, Water yield, Southern Appalachian Mountains, Blue Ridge Mountains.

This paper deals with the yield, timing, and quality of water flowing from forested watersheds of the southern Appalachians and how these parameters are changed by management activities. (Forest Service)
W79-09880

3C. Use Of Water Of Impaired Quality

A STUDY OF THE REUSE OF REUSED WATER,
Construction Engineering Research Lab. (Army), Champaign, IL.
E. D. Smith, R. M. Sweazy, G. A. Whetstone, and R. H. Ramsey.
Ground Water, Vol. 17, No. 4, p 366-374, July-August 1979. 5 fig, 4 tab, 14 ref. OWRT C-6053(no. 5205) (4), 14-31-0001-5205.

Descriptors: *Water reuse, *Irrigation water, *Lakes, *Water wells, *Texas, Water quality, Reclaimed water, Sewage effluents, Irrigation, Nutrients, Agriculture, Recreation facilities, Model studies, Hydraulic models, Algae, Bacteria, Fish, Urban runoff, Impaired water use, *Lubbock(TX), *Lubbock Canyon Lakes.

Lubbock is located in the center of the semiarid High Plains of Texas. Due to a shortage of adequate water-based recreational facilities in the region, the City Planning Department developed a scheme for converting an 8-mile intracity canyon into a linear park containing a series of small recreational lakes. Funds amounting to over $11,000,000 were committed to the project by a local bond issue and various governmental organizations. The proposed lake makeup water is unique. Never before has a serious attempt been made to develop recreational lakes utilizing urban runoff and twice-used reclaimed municipal wastewater as the sole source of supply. The majority of the makeup water will be obtained from wells on a farm which has received the major portion of Lubbock's secondary treated sewage since 1938 and used it for irrigation purposes. In order to ascertain the suitability of utilizing this reclaimed sewage effluent for recreational purposes, the Texas Tech University Water Resources Center, with the aid of an OWRT grant, constructed a model system designed to simulate the lake project. Research performed to date includes algal growth potential studies, water quality analyses, bacteriological assays, viral assays, and fish life studies. (Sims-ISWS)
W79-09846

DRAINAGE PRACTICE IN IMPERIAL VALLEY,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
L. F. Hermsmeier.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 105-109, February 20, 1978. 1 fig, 7 tab, 10 ref.

Descriptors: *Salinity, *Drainage practices, Drainage programs, Colorado River Basin, Saline water, Salt balance, Colorado River, California.

The Imperial Valley in California has been irrigated by Colorado river water from the start of the century. The irrigation water quality was recognized as presenting possible drainage and salinity problems. As early as in 1902, irrigation engineers of the U.S. Department of Agriculture indicated that the water table and salinity of the valley needed to be controlled. Even to this day, the salinity remains to be a problem in the Imperial Valley. The purpose of this paper was to describe briefly all the drainage studies and developments that have taken place until recent years. It also reports the soil types, climate, drainage cost and the crops grown in the valley. (Skogerboe-Colorado State)
W79-09910

3F. Conservation In Agriculture

INTAKE CHARACTERISTICS OF IRRIGATION FURROWS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W79-09909

PREDICTING IRRIGATION RETURN FLOW RATES,
Science and Education Administration, Brawley, CA.
J. A. Bondurant, C. E. Brockway, and M. J. Brown.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 6, p 1142-1143, December 20, 1978. 2 fig, 2 tab, 4 ref.

Descriptors: *Return flow, Sediment load, *Sediment distribution, Streamflow, Design flow.

Return flows from irrigated areas in southern Idaho were analyzed and a relationship was developed that characterizes flows by relating the cumulative percent of total seasonal flow to maximum flow rate. Since maximum flow rate can be estimated from channel characteristics and flow evidence, it was suggested that design flow rates' sediment ponds can be selected where flow records are not available. (Skogerboe-Colorado State)
W79-09913

THE ROLE OF EVAPOTRANSPIRATION MODELS IN IRRIGATION SCHEDULING,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2D.
W79-09914

ESTIMATING SPRINKLER DISTRIBUTION PATTERNS USING LINEAR REGRESSION,

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. Karmeli.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 4, p 682-686, August 20, 1978. 5 fig, 2 tab, 5 ref.

Descriptors: *Sprinkler irrigation, Distribution patterns, Estimating equations, *Regression analysis, Spatial distribution.

The linear regression was used to describe sprinkler distribution patterns. The linear fit was found to approximate the distribution very well in a wide range. This approximation proved to produce good estimates for both high and low quality distributions. In the higher quality distributions, the linear regressions model estimated the actual field data as well as the normal model. However, in lower quality distributions the linear regression model proved significantly better than the normal model in its estimates. A new coefficient, UCL, was suggested for practical use. (Skogerboe-Colorado State)
W79-09915

TRAVELING BOOM SPRINKLER OPERATION IN WIND,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
H. Shull, and A. S. Dylla.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 537-539, May-June 1979. 5 tab, 11 ref.

Descriptors: *Irrigation, *Sprinkler irrigation, *Irrigation practices, *Winds, On-site investigations, Equipment, Irrigation systems, Data processing, Distribution patterns, Effects, Agriculture, Traveling boom sprinklers.

Field testing has shown that if suitable travel land spacings are used, a traveling boom sprinkler irrigation system can provide uniform water distribution under low winds. If daily wind speed varies, and exceeds about 2 m/s, no lane spacing will give uniform water distribution under all wind conditions. (Sims-ISWS)
W79-09967

MULTIPLE EMITTER FLOW CONTROL,
M. H. Christy, and L. Spencer.
U.S. Patent No. 4,147,307, 7 p, 18 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 136, April 3, 1979.

Descriptors: *Patents, *Irrigation, *Flow control, Irrigation efficiency, Irrigation practices, Application equipment, Drip irrigation.

A drip or trickle flow emitter system utilizes a normally flat irrigation flow tube. A series of outlets are fitted with a series of flush-drip emitters capable of extending radially for flush flow. The tube is biased so assume a flattened profile between irrigation cycles so that its wall opposite the outlets applies a force between irrigation cycles so that its wall opposite the outlets applies a force causing the emitters to bend and in bending close the emitters sufficiently to exclude insects and prevent the entrance of exploratory hair roots of plants. The tube expands in response to internal water pressure toward an essentially cylindrical profile to clear the radially inner ends of the emitters and permit expansion to undergo a flush flow phase, followed by collapse to drip flow as the water pressure exceeds a predetermined value. (Sinha-OEIS)
W79-10018

THE ECONOMIC VALUE OF IRRIGATION WATER IN THE WESTERN UNITED STATES,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6B.
W79-10023

SCHEDULING TRIMS BACK WATER USE BY 7.3 INCHES PER ACRE,
R. Ross.
Irrigation Age, Vol. 12, No. 9, p 19-20, July-Aug., 1978.

Descriptors: *Scheduling, *Control systems, *Economic feasibility, *Economic justification, *Irrigation practices, Decision making, Operations research, Coordination, Water utilizations, Economic impact, Leaching, Soil-water-plant relationship, Water conservation.

Despite the recent emphasis by irrigators on scheduling to save pumping costs and reduce the occurrence of overpumping to leach nitrates and provide suitable soil moisture conditions, only a small share of the potential savings have yet to be realized. Focusing upon the 800,000 acres in Nebraska which were scheduled for irrigation last year, this analysis illustrates how, with the proper determination of how much and when to apply water to the crop and leach nitrates, the University of Nebraska extension service was able to save 5.8 million acre inches of water in this area in 1977. It is emphasized however that the implementation of advanced irrigation scheduling technology requires people trained and skilled in the basic and practical aspects of maintaining the proper soil-plant-water relationships in the field. The ability to provide such people at the Federal, State, and District levels will determine the success of scheduling as a conservation technique. (Tickes-Arizona)
W79-10070

IRRIGATION WATER CONSERVATION USING WIDE-SPACED FURROWS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
J. F. Stone, J. E. Garton, B. B. Webb, H. E. Reeves, and J. Keflemariam.
Journal of the Soil Science Society of America, Vol. 43, No. 2, p 407-411, Mar.-Apr., 1979. 3 tab, 1 fig, 9 ref.

Descriptors: *Irrigation practices, *Furrow irrigation, *Crop response, *Soil water movement, *Environmental effects, Water conservation, Soil texture, Irrigation efficiency, Agronomic crops, Infiltration.

With the purpose of examining the possibility of conserving water through wide-spaced furrow irrigation while maintaining yields at acceptably high levels, studies were conducted with three crops at three locations in Oklahoma over eight growing seasons to compare the results of water applications to narrow- and wide-spaced furrows. Irrigation treatments consisting of several modes of water application included: (1) irrigation of every furrow, (2) irrigation of alternate furrows, and (3) irrigation of alternate furrows alternately. Responses of cotton (Gossypium hirsutum L.) grain sorghum (sorghum bicolor L.) and soybeans (Glycine max L.) indicated that wide-spaced furrows required about half the water of narrow-spaced furrows with no reductions in yield occurring in 9 of 11 trials. Where yield reductions did occur it was noted that atmospheric evaporative demands were high, suggesting the possible critical effect of high winds and low precipitation. It is concluded that the principle of water conservation using wide-spaced furrows required a medium to fine textured soil to ensure that lateral water movement from the furrow was about the same distance as vertical infiltration. (Tickes-Arizona)
W79-10074

SPRINKLER IN THE DESERT,
Central Arid Zone Research Inst., Jodhpur (India).
P. Singh, and Z. D. Kavia.
Indian Farming, Vol. 28, No. 6, p 5-7, September 1978, 1 tab.

Descriptors: *Irrigation efficiency, *Irrigation systems, *Sprinkler irrigation, *Irrigation practices, *Crop response, Economic feasibility, Lateral conveyance structures, Crop production, Irrigation effects, Soil-water-plant relationships, Human resources, Economic impact, India.

Sprinkler irrigation has been studied as an alternative to conventional surface irrigation techniques in arid and semi-arid regions where crop failures frequently result not from short supplies of water but from evaporation, seepage and deep percolation. An operational research project has been conducted by the Central Arid Zone Research Institute at Jodhpur, India to determine the comparative efficiency of sprinkler irrigation systems in a cluster of 5 villages. Reported here are the results of one of these village studies where water was pumped either into a 12.3 x 12.6 x 2.3 M3 cemented pond and conveyed to the fields through open earthen channels under a gravity system, or into a sprinkler system. Results have indicated that the sprinkler system (1) permitted a 100% saving in water and doubled the irrigation command area, (2) economized labor for making channels, ridges, etc., (3) resulted in a 25% additional harvest on a unit area basis and a 150% increase on an irrigation command basis, and (4) significantly economized on labor used for water application and on recurring investments to pump water from the well to the pond and then to the field. (Tickes-Arizona)
W79-10079

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DEVELOPMENT OF AN EXTENSION OF ILLUDAS MODEL FOR CONTINUOUS SIMULATION OF URBAN RUNOFF QUANTITY AND DISCRETE SIMULATION OF RUNOFF QUALITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2A.
W79-09832

ENVIRONMENTAL EFFECTS OF COMPLEX RIVER DEVELOPMENT,
Westview Special Studies in Natural Resources and Energy Management, Westview Press, Boulder, Colorado, 1977. 172 p, 27 fig, 11 tab. G. F. White, ed.

Descriptors: *Water resources, *River basin development, *Environmental effects, *Water supply, *Developing countries, Water quality, Runoff, Water demand, Ecosystems, Climate, Alternative planning, Long-term planning, Trends, Water management(Applied), Feasibility.

To solve the pressing current problems of a limited water supply, we must always act with a global view to the future. Recognizing this, an international group of scholars--from the Soviet Union, Canada, Africa, and the United States--has met to review their experiences and research on the environmental effects of a number of large scale river management programs. This edited collection of their reports provides a balanced view of a vital element in the total ecosystem. Their analysis points out the urgent need to consider long-term trends in climate, to account for all feasible management alternatives, and especially to manage demand (as opposed to simply increasing water supply) and to defer irreversible action until all environmental impacts are estimated. The eight articles contained herein consider: (1) the comparative analysis of complex river development; (2) the Volga River; (3) the water economy and ecological problems of the Azov Sea; (4) transferring runoff from Northern and Siberian Rivers to the arid regions of the European USSR, Soviet Central Asia, and Kazakhstan; (5) the Columbia River; (6) changing approaches to managing water in the Fraser River Basin; (7) the Plate River Basin; and (8) observations from Kenya. (Bell-Graf--Cornell)
W79-09848

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
J-L. Chao.

Journal of the American Water Works Association, Vol. 71, No. 5, p 259-263, May 1979. 10 fig, 4 ref.

Descriptors: *Pumping, *Water distribution(Applied), *Electric power, *Costs, Reservoir storage, Pumping plants, Water demand, Energy, Feasibility, Economics, Hydraulics, Pipelines, Equations, Operations research, Demand curve, Hazen-Williams equation, Off-peak pumping.

Rising energy costs and environmental concerns necessitate a reevaluation of conventional utility operations; utilities have proposed various methods of load management to meet increased demands. Electrical utilities are considering various options for load management by rate design. Clearly, time-of-use rates could significantly affect water utilities that require electric power for pumping their supplies. Examined herein is the feasibility of off-peak pumping in existing water distribution systems and the economics of various pumping and storage patterns under time-of-use power rates. The principal factors for study are: the available reserve pumping and reservoir capacities; the relative magnitude of system friction loss compared to static lift; and the interrelationship of these parameters with the system daily demand pattern. It is concluded that characteristics of individual distribution systems differ, and so the feasibility of adopting off-peak pumping should be investigated on a case-by-case basis. It is probable that few existing water distribution systems have the reserve pumping, transmission main, and reservoir storage capacities needed to pump only at off-peak hours; secondary pumping at a lower rate during peak hours may be required to compensate for these deficiencies. (Bell-Graf--Cornell)
W79-09860

COMPUTER APPLICATIONS: A TOOL FOR WATER DISTRIBUTION ENGINEERING,
Gilbert/Commonwealth, Reading, PA.
J. L. Caves, and T. C. Earl.
Journal of the American Water Works Association, Vol. 71, No. 5, p 230-235, May 1978. 9 fig, 7 ref.

Descriptors: *Water distribution(Applied), *Computers, *Technology, *Engineering, Data storage and retrieval, Hydraulics, Steady state, Design, Simulation analysis, Water storage, Pumping, Hydraulic surge, Control, Planning, Maintenance, Networks, Cost effective.

Improvements in digital computer hardware have coincided with important advances in the use of computers to solve complex problems. Considerable benefit can be realized from recent advances in computer applications technology in the field of water distribution engineering. Discussed are the areas of distribution system data, hydraulic analysis (steady state) and design, storage simulation, hydraulic surge, control systems, maintenance, planning, and implementing computer applications. Provided is an overview of techniques relating technological advances to conditions that commonly exist in water distribution. The application of computer capabilities to the technical functions of water distribution will become increasingly important as both the costs of distribution and public pressure to reduce these costs escalate. The advanced computer techniques described herein offer water utilities tools for acquiring greater engineering insight and understanding of the complexities of their distribution systems. (Bell-Graf--Cornell)
W79-09875

DEVELOPING A COMPUTER PROGRAM FOR DISTRIBUTION SYSTEM ANALYSIS,
CH2M/Hill, Inc., Corvallis, OR.
A. L. Davis, and R. W. Jeppson.
Journal of the American Water Works Association, Vol. 71, No. 5, p 236-241, May 1978. 4 fig, 17 ref.

Descriptors: *Water distribution(Applied), *Computer programs, *Systems analysis, *Networks, Reservoirs, Pumps, Pipes, Simulation analysis, Evaluation, System performance, Equations.

Computer analysis tools have been developed for evaluating the performance of both current and proposed systems at moderate cost. These tools include time-saving input and output devices, formats, and an analysis program that simulates all appurtenances commonly encountered in a water distribution system. Considered herein are general principles of network analysis in which a system of simultaneous equations is solved; considered are the Newton method, the Hardy Cross method, the Darcy-Weisbach equation, and the Hazen-Williams equation. Discussed are: requirements for computer analysis of networks, including effective man-machine interface and systems analysis; and program development, performance, and applications. Using the computer tools discussed herein, both steady-state and time-dependent simulations can be performed. (Bell-Graf--Cornell)
W79-09876

MODELING WATER DISTRIBUTION IN SANTA CLARA COUNTY, CALIF.,
National Inst. for Water Research, Pretoria (South Africa).
G. C. Hall, and L. Ortolano.
Journal of the American Water Works Association, Vol. 71, No. 5, p 242-247, May 1978. 3 fig, 8 ref.

Descriptors: *Water distribution(Applied), *Simulation analysis, *Optimization, *Cost minimization, *Water delivery, *Scheduling, Computers, Planning, Monthly, Linear programming, Equations, Decision making, Groundwater basins, Constraints, Santa Clara County(CA), Mathematical models, Systems analysis.

In planning for the allocation of water supplies, the Santa Clara Valley Water district must decide on monthly delivery schedules for the annual entitlements of imported water; the district must also decide how to distribute these imported supplies and the precipitation in local basins among various water treatment plants and groundwater recharge basins. The district relies on a simulation model to determine distribution schedules, but this model does not account systematically for economic factors such as the cost of water transmission between various points in the distribution system. Research at Stanford University has derived an improved modeling procedure utilizing the district's simulation model in tandem with a linear programming (LP) optimization model. This article discusses: the nature of the district's distribution problem; the district's simulation model, including model inputs and outputs and model usage; the linear programming model, the objective function of cost minimization, and the problem constraints; and the tandem use of the LP and simulation models for computerized planning of monthly distribution schedules, which provides technically feasible and economical results. (Bell-Graf--Cornell)
W79-09877

SUBSIDENCE RELATED TO LAND USE IN EVERGLADES AGRICULTURAL AREA,
Agricultural Research and Education Center, Belle Glade, FL.
S. F. Shih, J. W. Mishoe, J. W. Jones, and D. L. Myhre.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 560-563 and 568, May-June 1979. 2 fig, 4 tab, 6 ref.

Descriptors: *Subsidence, *Land subsidence, *Land use, *Agriculture, *Florida, Soils, Organic soils, Surveys, On-site investigations, Regression analysis, Statistics, Statistical analysis, Crops, Pasture, Field crops, Vegetable crops, Farm practices, Drainage, *Everglades agricultural area.

Historical data obtained from the organic soil subsidence lines established in the Everglades Agricultural Area were examined statistically to relate subsidence rates to differences in land use conditions and locations. The rate of subsidence varied from 1.5 to 3.1 cm/yr. Subsidence rates varied depending on land use. Based on the conventional water control systems of the past 35 years, the order of subsidence rates for different land uses was field crops, truck crops, sugarcane, virgin grass, pasture. (Sims-ISWS)
W79-09968

FLOOD PLAIN INFORMATION: POJOAQUE RIVER AND TRIBUTARIES, SANTA FE COUNTY, NEW MEXICO,
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-10012

FLOOD PLAIN INFORMATION: MIMBRES RIVER AND FLORIDA GAP DRAW, DEMING, LUNA COUNTY, NM.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-10013

FLOOD HAZARD ANALYSES, WORTHLEY BROOK, TOWN OF POLAND, MAINE, ANDROSCOGGIN COUNTY,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-10014

4B. Groundwater Management

LAGOON RECHARGE OF THE FOLKESTONE BEDS AT HARDHAM, SUSSEX--1972-75,
Southern Water Authority, Eastleigh (England). Directorate of Resource Planning.
D. Izatt, G. B. Fox, and M. Tague.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 3, p 217-236, May 1979. 8 fig, 4 tab, 8 ref.

Descriptors: *Artificial recharge, *On-site investigations, *Aquifers, *Pit recharge, Lagoons, Recharge ponds, Methodology, Foreign research, On-site tests, Groundwater recharge, On-site data collections, Infiltration rates, Water quality, Deposition(Sediments), Head loss, Pore pressure, Rivers, *England, *Folkestone beds(England), Bed clogging, Recharge rates.

The paper summarized experiments carried out at an experimental lagoon site at Hardham Church Farm, 1 km south of Pulborough, Sussex during the period August 1972 to March 1975. The experiments involved artificial recharge of the Folkestone Beds aquifer with raw river Arun water. The objectives were: (1) to determine the extent of the Folkestone Beds aquifer, its coefficients of transmissivity and storage, its storage capacity, and its maximum yield; (2) to determine the sedimentation rate and changes in sediment load of the raw river water at various tidal and seasonal periods; (3) to ascertain the recharge rates which could be achieved utilizing both treated and untreated river water, the suspended solids/biological/chemical clogging effects, the effects of head variation and filter media on clogging, and the most effective recharge pattern; (4) to determine the chemical changes taking place in the recharge water on its passage through the aquifer, and the resulting water quality; and (5) to assess the development costs of recharge, abstraction, and treatment. Average lagoon recharge rates ranged from 2.1 m/day to 0.8 m/day per unit bed area, reflecting the complexity of lagoon recharge behavior and characteristics experienced. The cycles lasted up to 110 days, depending on the clogging of the lagoon beds. The main clogging agent was suspended solids present in the river water (coarse to medium silt), although algal growth in the lagoons made a significant contribution. Chemical clogging was insignificant. Severe clogging was limited to the top few centimeters of the beds, although some sediment penetrated to at least 15 to 20 cm. Other factors influencing lagoon recharge behavior were temperature of the recharge water, growth of the recharge mound, mutual interference between the lagoons, and bed-cleaning activities. Few changes in the hydrochemistry of the recharged water occurred, namely, a slight reduction in pH, total hardness, alkalinity and calcium, and a marked reduction in dissolved iron and manganese. The lagoon beds were cleaned by manual scraping, drag-line, wheeled shovel loader, and tracked shovel loader. Operating costs for 1973-74 and

1974-75 were 1.37 pence/cu m and 1.97 pence/cu m. (Humphreys-ISWS)
W79-09988

FERTILIZER NITROGEN DISTRIBUTION UNDER IRRIGATION BETWEEN SOIL, PLANT, AND AQUIFER,
Minnesota Univ., St. Paul.
J. R. Gerwing, A. C. Caldwell, and L. L. Goodroad.
Journal of Environmental Quality, Vol. 8, No. 3, p 281-284, July-September, 1979. 3 fig, 2 tab, 20 ref. OWRT A-034-MINN(1).

Descriptors: *Nitrogen fertilizers, Irrigation water, *Groundwater, Leaching.

A field experiment was established on a Sverdrup sandy loam in Central Minnesota to evaluate the effects of amounts and timing of nitrogen (N) fertilizer applications on N uptake by irrigated corn (Zea mays L.) and the movement of N into the aquifer 4.5 m below the soil surface. Nitrogen was applied as urea at rates of 179 and 269 kg N/ha in one application at planting or in split applications through the season. Soil solution analysis showed NO3 moving below the rooting zone in all plots with much higher concentrations below the one-time fertilizer applications. Split applications of N had only minimal effect on the concentration of NO3-N in the aquifer but one-time applications increased the concentration by 7 and 10 ppm. The use of 15N showed that splitting the 179-kg rate increased the N in the plant derived from fertilizer from 33.1 to 54.5%, and increased the recovery of fertilizer N by the plant from 30.4 to 52.1%, even though whole plant yields were not affected. Nearly one-fourth of the applied N remained in the upper 45-cm soil layer at harvest regardless of treatment. No accumulation of NO3 was found in the soil profile or underlying material to a depth of 3.0m. (Blake-Minn)
W79-10024

4C. Effects On Water Of Man's Non-Water Activities

CAN FOREST LAND PRODUCE WOOD, RECREATION, AND HIGH QUALITY WATER TOO,
Northeastern Forest Experiment Station, Parsons, WV.
J. H. Patric.
The Northern Logger and Timber Processor, Vol. 27, No. 12, p 6-7, 36-37. 1979.

Descriptors: *Demonstration watersheds, *Forestry, Sediment yield, Specific conductance, Land use, Logging, Roads, West Virginia.

The watershed of Elk Lick Run, a 1,400-acre portion of the Fernow Experimental Forest, supplies water to Parsons, West Virginia. Land use in this area since 1900 is reviewed. Scientists, loggers, and recreationists use the area heavily, perhaps as heavily as any municipal watershed in eastern United States. The effects on chemical and physical properties of water are minimal. Restricted use of the watershed would have cost the public far more, in terms of foregone wood and jobs, than the public would have gained in benefits to water resources. (Forest Service)
W79-09851

DRAINAGE PRACTICE IN IMPERIAL VALLEY,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
For primary bibliographic entry see Field 3C.
W79-09910

4D. Watershed Protection

SOME EFFECTS OF UREA FERTILIZATION ON A FORESTED WATERSHED IN WEST VIRGINIA,
Northeastern Forest Experiment Station, Parsons, WV.
For primary bibliographic entry see Field 2K.
W79-09847

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE CHEMICAL COMPOSITION OF THE UPPER HENNOPS RIVER AND ITS IMPLICATIONS ON THE WATER QUALITY OF RIETVLEI DAM,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien, and R. D. Walmsley.
Water S.A., Vol. 5, No. 2, p 77-89, April 1979. 6 fig, 6 tab, 18 ref.

Descriptors: *Water quality, *Water chemistry, *Eutrophication, Algal blooms, Oxygen requirements, Sewage effluents, Marshes, Sodium, Potassium, Calcium, Magnesium, Alkalinity, Nitrogen, Reservoirs, Hennops River, Rietvlei Dam.

A chemical investigation of the upper Hennops River was conducted between 1973 and 1975. Rietvlei Dam, situated on the Hennops River, has been a source of water supply to the city of Pretoria since 1933. Secondary treated sewage effluents from Kempton Park are discharged into the upper Hennops River approximately 25 km upstream from Rietvlei Dam. Up to 73% of all the annual inflow into Rietvlei Dam consists of discharged sewage effluents. The Hennops River is joined above the dam by smaller non-perennial tributaries. The river rises in a marshy area (vlei), passes through a swamp before receiving the Kempton Park discharge, and then passes through two more vlei before the dam catchment area. Nine sampling stations were selected at intervals along the course of the river to estimate the change in composition of the water with distance from the sewage plant. Automated techniques were used for analysis of sodium, potassium, calcium, magnesium, chloride, sulphate, conductivity, ammonia, nitrate, nitrite, Kjeldahl nitrogen, orthophosphate, total dissolved phosphate, silica, alkalinity, and chemical oxygen demand. Results show that water quality just above the dam is good. Rietvlei Dam is highly eutrophic as far as phosphorus is concerned. Evidence suggests that vlei systems may be important in removing both available nitrogen and phosphorus from the river, and the establishment of artificial vlei systems should be considered. (Seigler-IPA)
W79-09843

UNCERTAINTY ANALYSIS APPLIED TO VOLLENWEIDER'S PHOSPHORUS LOADING CRITERION,
Michigan State Univ., East Lansing.
K. H. Reckhow.
Journal of the Water Pollution Control Federation, Vol. 51, No. 8, p 2123-28, August 1979. 5 fig, 2 tab, 7 ref.

Descriptors: *Water quality, *Statistical methods, *Lakes, *Phosphorus, *Loading, *Vollenweider criterion axes, *Trophic states, *Uncertainty analysis, Mathematical models, Equations, Systems analysis, Sediments, Regression analysis, Estimating, Prediction, Probability.

Vollenweider's phosphorus loading criterion, like most mathematical models and graphical loading criteria, suffers because uncertainty is ignored. Uncertainty is present in the application of a loading criterion to estimate trophic state inasmuch as the criterion is subject to professional disagreement and estimation error and inasmuch as the input variables, particularly phosphorus loading, are not known with certainty. A graphical procedure is proposed here that assigns confidence limits, reflecting estimation error, to the trophic state transition lines on Vollenweider's criterion axes. Additional graphs that can be used to combine the loading criterion error with the loading uncertainty for a particular lake are then presented. These graphs provide an estimate of the likelihood that a lake will become oligotrophic, mesotrophic, or eutrophic. (Bell-Graf--Cornell)
W79-09856

WATER QUALITY SAMPLING PROGRAMS IN RIVERS,
Melbourne Univ., Parkville (Australia). Centre for Environmental Studies.
G. C. Dandy, and S. F. Moore.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE4, p 695-711, August 1979. 6 fig, 1 tab, 24 ref.

Descriptors: *Water quality, *Sampling, *Rivers, *Programs, *Stochastic processes, *Methodology, *Water analysis, *Design, Model studies, Systems analysis, Equations, Decision making, Dissolved oxygen, Biochemical oxygen demand, Streamflow, Simulation analysis, Monitoring, Probability, Dynamic programming, Optimization, Algorithms, Standards, Cost-effective, Shenango-Beaver River(PA), Cost minimization, Long-term trends.

A central decision in the collection of water quality data from a river is the choice of the locations and frequencies of sampling. This paper proposes a methodology for the selection of these design variables, for given water quality constituents, based on the use of a stochastic model of the river. The design method is demonstrated for the coupled constituents of BOD and DO in the Shenango-Beaver River, Pennsylvania. Cost-effective sampling designs are identified, using a dynamic programming algorithm, for two principal objectives: (1) detection of violations of in-stream water quality standards; and (2) assessment of the present state of water quality in the river. The objective function is cost minimization. Results indicate that efficient designs for the abatement function tend to emphasize intensive sampling at a few critical locations. Efficient designs for the prevention function, however, emphasize sampling effort distributed spatially over the river network. (Bell-Graf--Cornell)
W79-09859

A COMPARATIVE CASE STUDY OF DYNAMIC MODELS FOR DO-BOD-ALGAE INTERACTION IN A FRESHWATER RIVER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
M. B. Beck.
Publications No. RR-78-19, December 1978. 66 p, 9 fig, 15 tab, 51 ref, 2 append.

Descriptors: *Comparison, *Simulation analysis, *Biochemical oxygen demand, *Dissolved oxygen, *Freshwater, *Rivers, *Model studies, *Water quality, *Field data, Equations, Systems analysis, Dynamic models, Black box model, Model development, Response error statistics, Assessment, Cam River system(Great Britain).

There is a need for comparative studies of different model types against the same set of field data. Although models can be readily applied in management and decision making, they are not always so readily subject to a prior verification against field data from the river system. The primary goal of this paper is the dissemination of a set of time-series field data suitable for the identification and verification of dynamic models for water quality. Here water quality is interpreted as the interaction between three variables: dissolved oxygen concentration; biochemical oxygen demand concentration; and a population of algae. A secondary objective is the comparison, by means of response error statistics, of several models that have been derived by reference to the field data. A third objective is to present a summarizing and concluding statement

on river water quality model development exercise which spans various publications over the past few years. In terms of model comparison and assessment, the paper concludes with a cautionary message on the use of simple fitting error statistics; it is argued that judgments about the 'best' model are dependent upon the intended application of the model. On the accuracy of the models as representations of the real system, it is found that many questions are unresolved, particularly for those aspects related to the growth kinetics, death, and decay properties of floating algal populations. (Bell-Graf--Cornell)
W79-09862

ELEMENTS OF A WATER QUALITY INFORMATION SYSTEM FOR THE STATE OF ILLINOIS,
Northern Illinois Univ., DeKalb. Dept. of Geology.
R. C. Flemal, D. C. Wilkin, and B. B. Ewing.
Water Resources Bulletin, Vol. 15, No. 4, p 996-1003, August 1979. 6 tab, 7 ref.

Descriptors: *Water quality, *Information system, *Illinois, Planning, Environmental quality, Streams, Monitoring, Decision making, Standards, Performance, Seasonal, Time-trend analysis, Effects, Dissolved solids.

A large amount of information can be derived from the study of standard stream monitoring data, if these are properly ordered and organized. This information may then be used to make decisions concerning water quality management. Among critical information items are evaluation of performance to standards, determination of seasonality and time-trends of water quality conditions, and estimation of the effects on water quality to be expected from load reductions or standards modifications. Additional information on the magnitude of individual pollution sources is also critical to water quality management. Each of these items can be derived within the water quality information system which is currently under development for the State of Illinois. (Bell-Graf--Cornell)
W79-09869

CONSEQUENCES OF HARVESTING AND SITE PREPARATION IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
W. L. Nutter, and J. E. Douglass.
In: Proceedings: A symposium on principles of maintaining productivity on prepared sites, March 21-22, 1978, Mississippi State University, p 65-72, 1978. USDA Forest Service, Southern Forest Experiment Station and Southeast Area State and Private Forestry, New Orleans, Louisiana, 22 ref.

Descriptors: *Erosion, *Water quality, *Suspended sediments, *Erosion control, *Forest practices, Piedmont soils.

Piedmont soils suffered years of abuse under agriculture. Now stabilized under forest, these sites are subject to change by harvesting and site preparation. Increased erosion and lowered water quality may occur as a result. These changes can be controlled if the manager specifies conservation practices and the amount of mineral soil that can be exposed during harvest and regeneration. Methods of site preparation applied in the Piedmont need to be reexamined in light of specific silvicultural objectives and disturbance created by various methods. (Forest Service)
W79-09878

FLUCTUATIONS IN NATURALLY OCCURRING POPULATIONS OF ENTERIC BACTERIA IN OLIGOTROPHIC STREAMS OF WESTERN NORTH CAROLINA,
Georgia Univ., Athens.
M. R. McSwain, and W. T. Swank.
USDA Forest Service Research Paper SE-158, February 1977. 12 p, 4 fig, 3 tab.

Descriptors: *Heterotrophy, *Stream discharge, *Turbidity, *Coliform bacteria, *Streptococcus bacteria, Diurnal cycles, Stream nutrient content, Southern Appalachian Mountains, North Carolina.

In mountain streams of western North Carolina, naturally occurring populations of enteric bacteria fluctuated seasonally and diurnally. Seasonal fluctuations in total coliforms and fecal coliforms were apparently regulated by water temperature. Diurnal fluctuations in total coliforms were inversely related to daily cycles in streamflow. Total and fecal coliforms and fecal streptococci peaked during stormflows. These fluctuations complicate the assessment of water quality and should be considered in designs for stream sampling. (Forest Service)
W79-09902

SOIL WATER CONTENT AND TEMPERATURE AS FACTORS IN THE VOLATILE LOSS OF APPLIED MERCURY (II) FROM SOILS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 2K.
W79-09916

ELECTROCHEMICAL DETERMINATION OF HEAVY METALS IN WATER AND APPARATUS THEREFOR,
Siemens A.G., Munich (Germany, F.R.). (Assignee).
W. Kellermann, H. Nischik, and F. V. Sturm.
U.S. Patent No. 4,146,436, 9 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1403, March 27, 1979.

Descriptors: *Patents, *Monitoring, *Water pollution, Heavy metals, Electrochemistry, Chemical precipitation, Electrodes, Direct currents.

A method is described for electrochemically determining the concentration of heavy metals in water through precipitation of the metals at a solid electrode under the influence of a constant negative d-c voltage and subsequent dissolution of the metals by anodic oxidation. The process can be used for the automatic and unattended determination, recording and monitoring of heavy metals in water. This is achieved by: precipitating the metals at a metal electrode of the platinum family; after the precipitation of the metals, replacing the water by an electrolyte solution, dissolving the precipitated metals again by a sudden change of the negative d-c voltage into a constant positive d-c voltage, during which the electric charge required for the dissolution is determined and the concentration determined; and maintaining the application time and the magnitude of the d-c voltage always constant during the precipitation as well as during the dissolution of the metals. (Sinha-OEIS)
W79-09935

A SIMPLIFIED METHOD FOR THE SIMULTANEOUS EXTRACTION OF PHYTOPLANKTONIC CHLOROPHYLL AND FECAL STEROL FROM WATER,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
C. K. Wun, J. Rho, R. W. Walker, and W. Litsky.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 173-178, February 1979. 3 tab, 10 ref.

Descriptors: *Analytical techniques, *Chlorophyll, *Sewage, *Water quality, Solvent extractions, Laboratory tests, Resins, Plankton, Phytoplankton, Water pollution, Pollutants, Pollutant identification, Algae, Aqueous solutions, Chemicals, Chemical analysis, Coprostanol, Fecal sterol.

A simple column method employing Amberlite XAD-1 (60-120 mesh) resin for the simultaneous extraction of coprostanol and algal chlorophyll a was proposed and evaluated. The results showed that the efficiencies of the column extraction for these two water quality indicators were comparable to or better than the conventional hexane liquid/liquid partitioning and aqueous acetone extraction for the respective compounds. Furthermore, the column technique was time-saving and more economical. (Sims-ISWS)
W79-09979

CHLOROPHENOLS IN SURFACE WATERS OF THE NETHERLANDS (1976-1977),
Rijksinstituut voor de Volksgezond-heid, Bilthoven (Netherlands).
R. C. C. Wegman, and A. W. M. Hofstee.
Water Research, Vol. 13, No. 7, p 651-657, 1979. 6 fig, 6 tab, 12 ref.

Descriptors: *Water pollution, *Phenols, *Pesticides, *Laboratory tests, Analytical techniques, Chlorinated hydrocarbon pesticides, Gas chromatography, Chromatography, Rivers, Methodology, Testing procedures, Data collections, *The Netherlands, *Rhine River, *Meuse River, Chlorophenols, Monochlorophenols, Dichlorophenols, Trichlorophenols, Tetrachlorophenols, Pentachlorophenols.

An analytical method was described for the capillary gas chromatographic determination, after derivatization, of 19 individual chlorophenols in surface water. The minimum detectable amounts are for monochlorophenols 2 microgram/l, for dichlorophenols 0.05 microgram/l, for trichlorophenols 0.02 microgram/l, and for tetra- and pentachlorophenols 0.01 microgram/l. The results of a monitoring program in the river Rhine and other Dutch surface waters with respect to these compounds were presented. The results covered the period January 1976-December 1977. 2,6-Dichlorophenol, 2,4,6-trichlorophenol, 2,3,4,6-tetrachlorophenol and pentachlorophenol had the highest frequencies of occurrence in the river Rhine and its tributaries. Pentachlorophenol was found in the highest concentrations (up to 11 microgram/l). (Humphreys-ISWS)
W79-09987

PROCEEDINGS OF A WORKSHOP ON SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, ESTES PARK, COLORADO, JULY 10-14, 1978,
National Oceanic and Atmospheric Administration, Environmental Research Laboratories, Boulder, CO. March 1979. 228 p.

Descriptors: *Water pollution, *Pollutant identification, *Water pollution sources, *Water pollution effects, Chlorination, Dredging, Microorganisms, Metals, Fossil fuels, Litter, Conferences, *Outer Continental Shelf, Artificial radionuclides, Biological effects, Biostimulants, Synthetic organics.

The purpose of a workshop held in Estes Park Colorado on July 10-14, 1978, was to write a strong, comprehensive statement of the scientific problems of ocean pollution and identify research, development, and monitoring programs that should be undertaken in order to solve these problems. Following the review and overview of 'Ocean Pollution Research, Development, and Monitoring Needs' presented by E. D. Goldberg, the following workshop subjects are presented: Synthetic Organics, Chlorination Products, Dredging and Disposal of its Large-Volume Waste, Litter, Artificial Radionuclides, Microorganisms, Trace Metals, Biostimulants, Fossil Fuel Compounds, and Biological Effects - A Generic View. (See also W79-10050 thru W79-10059) (Sinha-OEIS)
W79-10049

NITRATE LEVELS IN GROUNDWATER FROM THE FLEUVE, SENEGAL,
Yale Univ., New Haven, CT. Dept. of Epidemiology and Public Health.
M. Berwick.
Progress in Water Technology, Vol. 11, No. 1, p 117-120, 1978. 1 tab, 20 ref.

Descriptors: *Water quality, *Animal diseases, *Human diseases, *Chemical analysis, *Public health, *Environmental effects, *Regional analysis, Nitrates, Arid lands, Environmental sanitation, Water pollution effects, Water quality control, Groundwater, Water resources development, Qualitative analysis, Senegal River Basin.

Nitrate concentrations of drinking water in arid regions of Africa, where they are likely to rise with the development of irrigation in the Senegal River Basin, have been found to be related to a number of diseases in infants and ruminants. Rec-

ognizing this relationship, the present study was carried out to determine the nitrate concentration of water samples collected from a number of sources within a 100 km radius of St. Louis, Senegal. Using the Brucine colormetric analysis, nitrate ion concentrations were found in some cases to be well in excess of acceptable levels. The risks of these high levels to infants and ruminants in Fleuve, Senegal are discussed with the suggestion that the problem deserves immediate attention. (Tickes-Arizona)
W79-10067

5B. Sources Of Pollution

A STUDY OF THE REUSE OF REUSED WATER,
Construction Engineering Research Lab. (Army), Champaign, IL.
For primary bibliographic entry see Field 3C.
W79-09846

USE OF BAKER'S YEAST TO TRACE MICROBIAL MOVEMENTS IN GROUND WATER,
Geological Survey, Reston, VA.
W. W. Wood, and G. G. Ehrlich.
Ground Water, Vol. 16, No. 6, p 398-403, November-December 1978. 6 fig, 9 ref.

Descriptors: *Yeasts, *Groundwater, *Microbial movement, *Tracers, *Water quality control, Contaminants, Experiments, Flow, Aquifers, Pumping, Wells, Pathogens, Pore volume, Sodium bromide, Calcium carbonate, Lithology, Stanton(TX).

Field and laboratory experiments were made using suspensions of baker's yeast (Saccharomyces cerevisiae) to trace the movement of microbes in artificially recharged groundwater. Yeast cells penetrated more than 7 meters into a sand and gravel aquifer in less than 48 hours. It is believed that most of the cells travelled through channels formed by the solution of calcium carbonate rather than through intergranular pores. Ease and sensitivity of detection, low cost, and negligible background correction suggest that baker's yeast is an excellent choice as a tracer for this type of application. (Bell-Graf--Cornell)
W79-09855

LOW PICLORAM CONCENTRATIONS IN STREAMFLOW RESULTING FROM FOREST APPLICATION OF TORDON-10K,
Southeastern Forest Experiment Station, Franklin, NC. Coweeta Hydrologic Lab.
D. G. Neary, J. E. Douglass, and W. Fox.
In: Proceedings of the Southern Weed Science Society, January 23-25, 1979, Atlanta, Georgia, p 77-89, 1979. Auburn University Printing Service, Auburn, Alabama. 4 fig, 3 tab, 25 ref.

Descriptors: *Herbicides, *Pesticide residues, *Watershed management, *Water quality, Soil, Nutrients, Streamflow, Forest management, *Picloram, *Tordon-10K, Southern Appalachian Mountains.

Tordon-10K (Trade name) pellets were applied to 4 ha of a watershed at the Coweeta Hydrologic Laboratory, Franklin, N. C., to prepare a low-quality hardwood stand for planting eastern white pine (Pinus strobus L.). The herbicide was applied in May 1978 at a rate of 50 kg/ha (5 kg/ha a.i. picloram). Although application was followed by dry weather conditions, 76 percent of the overstory plants and 95 percent of the rhododendron (Rhododendron spp.) and laurel (Kalmia latifolia L.) in the understory were initially affected. Probably because of drought, only 30 percent of the overstory and 20 percent of the understory plants were killed. During the first 5 months after application, soil solution at 30 cm contained less than 10 ppb picloram until heavy rains in August; then, a peak of 174 ppb was measured. At 60 cm, picloram peaked 2 months later at 179 ppb. In the soil solution sampled at 120 cm, picloram concentrations never exceeded 3 ppb. Picloram was only detected twice (late June and early July) in streamflow, and the maximum concentration was only 8 ppb. After heavy rains in August totalling nearly 290 mm, no picloram was detected in streamflow. No major leaching of anions or cations has been evident in soil solution or streamflow. Based on this early data obtained during an intermittently dry summer, it can be concluded that well-controlled applications of Tordon-10K to ridges and upper slopes should not produce any significant pollution of streams draining the deep soil systems of the southern Appalachians. (Forest Service)
W79-09864

COMPARISON OF MEMBRANE FILTERS IN RECOVERY OF NATURALLY INJURED COLIFORMS,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 7B.
W79-09890

FLUCTUATIONS IN NATURALLY OCCURRING POPULATIONS OF ENTERIC BACTERIA IN OLIGOTROPHIC STREAMS OF WESTERN NORTH CAROLINA,
Georgia Univ., Athens.
For primary bibliographic entry see Field 5A.
W79-09902

ALKANES IN SEAWATER IN THE VICINITY OF THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
B. S. Middleditch, B. Basile, and E. S. Chang.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, No. 3, p 413-420, 1979. 1 fig, 1 tab, 8 ref. NOAA 03-6-042-35120.

Descriptors: *Water pollution, *Oil fields, Gulf of Mexico, Pollutants, Organic compounds, Seawater, Hypolimnion.

Concentrations of alkanes in 76 water samples collected within 30 km of the Buccaneer oilfield were found to be as high as 43 ppb. It appeared that petroleum alkanes discharged from the production platforms float at the air/sea interface and are dispersed. Discharge from the production platforms of hydrocarbon-producing bacteria, or a nutrient which supports such bacteria, appeared to be responsible for the presence of bacterial hydrocarbons in bottom water samples down-current of the oilfield. (Chilton-ORNL)
W79-09905

PATHWAYS FOR MERCURY UPTAKE BY FISH FROM BED SEDIMENTS,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
A. Kudo, and D. C. Mortimer.
Environmental Pollution, Vol. 19, No. 3, p 239-245, July 1979. 3 fig, 1 tab, 8 ref.

Descriptors: *Water pollution, *Water pollution sources, Path of pollutant, Sediments, Rivers, Fish, Absorption.

In these laboratory investigations, organic-rich sediments from the Ottawa River were treated with mercuric chloride to produce a total mercury concentration of 1.023 ppm in the sediments. Experimental results showed that mercury accumulation by fish in contact with sediment contaminated by mercury was much higher than that accumulated from the overlying water. (Chilton-ORNL)
W79-09918

INPUTS AND OUTPUTS OF WATER AND PHOSPHORUS FROM FOUR VICTORIA CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Zoology.
I. C. Campbell.
Australian Journal of Marine and Freshwater Research, Vol. 29, No. 5, p 577-584, October 1978. 2 fig, 2 tab, 16 ref.

Descriptors: *River basins, *Phosphorus, *Streams, *Nutrient budgets, *Water balance, *Land use, *Watersheds(Basins), Victoria(Australia), Australia, Nutrients, Merri Creek(Australia), Little Yarra River(Australia), Cement Creek(Australia), Gardiner's Creek(Australia), Yarra River(Australia), Forest watersheds, Agricultural watersheds, Runoff, Precipitation(Atmospheric), Urban runoff.

Input-output studies of water and phosphorus in watersheds of four tributaries of the Yarra River, Victoria, Australia (1973-74) showed phosphorus gains in all but the urban watershed, with gain or loss chiefly determined by land use, rainfall, and amount of runoff generated by rainfall. All watersheds are low relief (0-300 m altitude). The Merri Creek catchment (380 sq km) is primarily used as a pasture for sheep and cattle (300 sq km), but also contains 80 sq km of heavy and light industry and moderate-to-high population density. Gardiner's Creek catchment (100 sq km) is entirely within metropolitan Melbourne. The Little Yarra River catchment (140 sq km) is 65% forested and the rest in pasture. Cement Creek catchment (13 sq km) is entirely forested. Stream discharge as a percentage of rainfall volume is considerably smaller for the Merri Creek (1%) and Cement Creek (8%) catchments than for Gardiner's Creek (22%) and Little Yarra River (25%). Phosphorus inputs were highest to Little Yarra River (14.3 kg/sq km/yr), followed by Cement Creek (13.2 kg), Merri Creek (10.1 kg), and Gardiner's Creek (9.2 kg). The greatest phosphorus output was from Gardiner's Creek (19.0 kg/sq km/yr), the only catchment in which phosphorus outflow exceeded input in precipitation, the excess attributed to detergents, sewage and drainage water, and industrial wastes. Phosphorus outflow is 8.3 kg from Little Yarra River, 2.4 kg from Cement Creek, and 1.6 kg from Merri Creek. Phosphorus levels increased markedly during high flow. (Lynch-Wisconsin)
W79-09921

NITROGEN-ISOTOPE RATIO STUDIES OF SOILS AND GROUNDWATER NITRATE FROM ALLUVIAL FAN AQUIFERS IN TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
C. W. Kreitler.
Journal of Hydrology, Vol. 42, No. 1/2, p 147-170, June 1979. 10 fig, 6 tab, 39 ref. NSF DES74-13560.

Descriptors: *Nitrogen, *Isotopes(Stable), *Nitrates, *Groundwater, *Texas, Fertilizers, Farm wastes, Alluvial fans, Aquifers, Sampling, Soil contamination, Water pollution, Denitrification, Ammonium salts, Ureas.

Average nitrate concentrations of 54 water samples from the Lockhart and Taylor alluvial carbonate gravel aquifers (central Texas) and of 37 groundwater samples from Seymour alluvial siliceous gravel aquifer are 75 and 138 mg/l, respectively. The dominant nitrate sources over the aquifers are cultivated land with ammonium-type fertilizer and animal wastes from livestock and domestic waste. The delta 15N of fertilizer nitrogen used on the Lockhart and Taylor fans ranges from -7.4 to +1.9 parts per thousand. The delta 15N range of 20 soil nitrate samples from 15 cultivated fields on the two alluvial fans is +2 to +14 parts per thousand with an average of +8.8 parts per thousand. This delta 15N range for ammonium-fertilized, cultivated fields is more positive than the delta 15N range of nonfertilized fields because of volatilization of ammonia depleted in 15N during and after fertilizer application, which leaves nitrate enriched in 15N. The delta 15N of groundwater nitrate from irrigation wells on the two fans range from +3.3 to +10.8 parts per thousand with an average of +7.3 parts per thousand. Groundwater from domestic wells on the two fans has higher nitrate concentrations and a more positive delta 15N range (+6.7 to +18.2 parts per thousand with an average of +11.1 parts per thousand) than wells located in the cultivated fields. Nitrate contamination of wells located in cultivated fields results primarily from cultivation with ammonium-type fertilizers, whereas animal wastes are contaminating domestic well waters. (Visocky-ISWS)
W79-09983

THE QUALITY OF RUN-OFF FROM AN IRRIGATED MARKET GARDEN AREA IN BRAZIL,

Balfour (D.) and Sons, London (England).
R. M. Bradley, and D. Cabral, Jr.
Water Research, Vol. 13, No. 7, p 589-598, 1979. 2 fig, 8 tab, 19 ref.

Descriptors: *Water quality, *Agricultural runoff, *Water pollution sources, *Water pollution, Runoff, Irrigation water, Nitrogen, Fertilizers, Nutrients, Phosphorus, Potassium, On-site investigations, Data collections, Foreign research, Vegetable crops, Soil, Drainage water, Rain water, Metals, Copper, Zinc, Manganese, Insecticides, Dieldrin, Endrin, DDT, *Brazil, Endosulphan.

This paper presented the results of a study carried out in Brazil to determine the effects of irrigation and fertilizer use on the quality characteristics of runoff from an agricultural area used for intensive cultivation of market garden produce. The results showed that during dry weather the discharge of nutrients from the cultivated area when irrigation is taking place is equivalent to 7 kg/ha/yr N and 1 kg/ha/yr P. Considerable accumulation of nutrients took place in the soil during the growing season; over the 129-day survey period the nutrient content of the top soil increased by approximately 590 g/sq m N and P and 780 g/sq m K. This accumulation was derived from fertilizers which were applied at rates of 1136 kg/ha N, 978 P, and 1367 K. During wet weather, the nutrients which had accumulated in the soil were washed out. (Humphreys-ISWS)
W79-09985

CONCENTRATIONS OF NITRILOTRIACETATE AND CERTAIN METALS IN CANADIAN WASTEWATERS AND STREAMS: 1971-1975,
Procter and Gamble Co., Cincinnati, OH.
C. R. Woodiwiss, R. D. Walker, and F. A. Brownridge.
Water Research, Vol. 13, No. 7, p 599-612, 1979. 12 tab, 13 ref.

Descriptors: *Water pollution, *Canada, *Waste water(Pollution), *Nitrilotriacetic acid, Streams, Water pollution sources, Phosphorous, Detergents, On-site investigations, Sewage treatment, Data collections, Analysis, Methodology, Seasonal, Copper, Chromium, Cadmium, Lead, Zinc, Iron, Aluminum, Nickel, Sodium.

At 13 Ontario cities, representing a variety of populations and sewage treatment processes, grab samples were taken from the sewage treatment plant influent and effluent and from the receiving stream above and below the sewage outfall. The samples, taken once each month from November 1971 to March 1975, were analyzed for nitrilotriacetate (NTA), 9 metals, and phosphorus. From April 1971 to January 1973, household detergents in Canada contained an average of 6% NTA; after March 1973, they contained 15%. This increased usage of NTA was reflected in the NTA content of sewage influents, which rose from a median level of 1.3 mg/l before the change to 3.2 mg/l after the change. NTA levels in sewage effluent also increased somewhat, but much of the NTA disappeared in the sewage treatment processes. Even with the increased usage of NTA, the receiving streams below the sewage outfall contained only low levels of NTA: 97% of all samples during this period contained less than 0.5 mg/l, and the median concentration was 0.05 mg/l. Phosphorus concentrations in the sewages decreased at the time detergent compositions changed. Comparison of metal concentrations before and after the change, as well as metal-NTA correlation coefficients, failed to show clear evidence of an association between NTA concentration and metal concentration. (Humphreys-ISWS)
W79-09986

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS MANAGEMENT AREA, EMMA STUDY, VOLUME 3B: STUDY OF WASTES FROM LARGE INDUSTRIES,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 796, Price codes: A13 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 55 p, 11 fig, 9 tab, 10 app. See also Summary Report and other Technical Data Volumes.

Descriptors: *Massachusetts, Waste water treatment, *Industrial wastes, *Data collections, *Water quality, *Waste water management, *Waste loads, Industrial plants, Industrial water, Chemical industry, Food processing industry, Mineral industry, Pulp and paper industry, Textiles, Data processing, Data storage and retrieval, Data transmission, Waste identification, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this portion of the study is to collect and interpret existing information on the quantity and quality of large industrial area manufacturing process wastewater discharges in the study area, and to project these discharges into the future. The data collected have been placed in a data retrieval and plotting system to be used as an effective planning tool. The industrial focus of this study is an outgrowth of earlier efforts to characterize industrial waste water in the area, which examined discharges from 27 industrial groups. This study investigates the larger industrial sites--those discharging 50,000 gallons of waste water per day; those whose water intake was low and where in excess of 250 persons were employed; and those with high intake employing in excess of 100 persons. These industrial lists are verified and the data form finalized. Data retrieval and plotting, verification, loading and selection are reviewed. The data are discussed and future waste load projections are made. All surveyed industries are listed and classified according to magnitude of discharge. Nine appendices list all industries surveyed, those discharging more than 50,000 gallons/day and those with zero discharge, and present detailed data for the industries surveyed. (See also W79-09992) (Zayac-NC)
W79-09995

WASTEWATER ENGINEERING AND MANAGEMENT STUDY FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 3A: STUDY OF CERTAIN INDUSTRIAL WASTES.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 797, Price codes: A08 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 224 p, 11 fig, 9 tab, 10 append.

Descriptors: *Massachusetts, *Data collections, *Industrial wastes, *Waste water treatment, *Water pollution sources, *Water quality, *Waste water management, Data processing, Data storage and retrieval, Data transmission, Measurement, Monitoring, Statistics, Surveys, Chemical wastes, Pulp wastes, Food processing industry, Mineral industry, Textiles, Information retrieval, Information exchange, Boston(MA), Data plotting, Data verification.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. The purpose of this portion of the study is to collect existing information and to generate new information on the magnitude and composition of certain industrial and manufacturing process wastewater discharge in the study area. The scope of the study was to inventory 27 industrial groups in 109 communities. Current levels of industrial waste were projected to the years 1990, 2020 and 2050. A detailed description of the methodology used is presented. Industrial literature surveys were undertaken. Location surveys were undertaken to collect location and site-specific data on the industrial groups covered by the study. A computer data retrieval system and plotting routine were developed to allow efficient use of the data files developed by the location surveys. The data are presented and discussed by industry. Data manipulations indicate that the current level of industrial process water discharge in the study area is 31,000,000 gallons/day for the 27 industrial groups. Of this, 92% of the total (28,600,000 gallons/day) is discharged by the 71 largest dischargers, while 56% of the locations discharged no process water. Projections of future industrial waste loads in the area indicate that improvements in water use technology will offset expected growth in industrial production; process wastewater volume from surveyed industries is expected to remain constant until 1990, with a rise to about 48,000,000 gallons/day by 2050. Nine appendices list all industries surveyed, and present detailed data for the industries surveyed. (See also W79-09992) (Zayac-NC)
W79-09996

A LAND-USE PLANNING MODEL FOR COASTAL ZONE MANAGEMENT,
State Univ. of New York at Stony Brook. Coll. of Engineering and Applied Sciences.
For primary bibliographic entry see Field 6A.
W79-10015

LEVELS AND SOURCES OF CRITICAL TRACE METALS IN THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
R. C. Clark, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 5-51, March 1979. 9 tab, 103 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Baseline studies, *Water pollution sources, *Metals, Resources development, Environmental effects, Copper, Chromium, Nickel, Cadmium, Lead, Mercury, Trace elements, *Outer Continental Shelf, Petroleum development.

Some of the elements in petroleum are also found in seawater where they range in concentration from a few percent to parts per trillion. The ecological aspects, or effects, of these elements may range from beneficial (essential) to detrimental (toxic). Any assessment of the biological effects of trace metals from petroleum on the marine environment must consider the levels of these elements in petroleum, drilling chemicals, and production (brine) waters; the levels naturally present in seawater; the chemical form of the metals; and the reactivity and toxicity of the chemical forms of the metals. There are six trace metals, namely, chromium, nickel, copper, cadmium, mercury, and lead, which occur in petroleum at trace levels and are toxic to at least some marine organisms at such levels. In view of their potential impact on the arctic and subarctic marine environments and organisms, these metals are considered in this report. (Sinha-OEIS)
W79-10040

ACUTE TOXICITY OF HEAVY METALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5C.
W79-10041

PROCEEDINGS OF A WORKSHOP ON SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, ESTES PARK, COLORADO, JULY 10-14, 1978,
For primary bibliographic entry see Field 5A.
W79-10049

DREDGING AND DISPOSAL OF ITS LARGE-VOLUME WASTE,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
M. G. Gross, W. D. Barnard, H. Bokuniewicz, C. G. Gunnerson, and M. N. Nichols.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 35-50, March 1979. 34 ref.

Descriptors: *Dredging, *Waste disposal, *Water pollution sources, Resources development, Dispersion, Outer Continental Shelf, Containment.

The discussion primarily concerns dredged material. Dredged material typically is composed mostly of inorganic sediment and often contains less than 10% organic matter by weight. However, some dredged material may contain domestic waste products. In some urban harbor areas subject to the discharge of large quantities of municipal wastes, sewage sludge may be a major component of dredged materials. Although typical dredged materials are not sewage sludge, many strategies are related to disposal of both organic-rich and organic-poor dredged sediments. Therefore, the disposal of dredged sewage sludge is included within the general framework of dredged material disposal. The discussion also considers incineration of wastes at sea, although it differs in many respects from dredging and related disposal activities. New sites must be designated for disposal of dredged materials and solid wastes. Choices must be made between containment and dispersal and each site must be evaluated on the basis of its physical, biological, and geological characteristics. (See also W79-10049) (Sinha-OEIS)
W79-10052

LITTER,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
E. J. Carpenter, W. J. Cretney, B. F. Morris, and R. L. Swanson.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 51-68, March 1979. 3 tab, 36 ref.

Descriptors: *Solid wastes, *Monitoring, *Water pollution sources, *Water pollution effects, Pollutants, Resources development, Outer Continental Shelf, Ocean pollution, Litter.

Knowledge of the role played by litter in marine ecosystems is extremely limited. This section summarizes current understanding of the litter problem, exposes critical areas that need further investigation, and recommends ways of monitoring this chronic type of pollution. The major problems deserving attention are identified as (1) identifying and quantifying specific litter materials found on widely varied areas, such as the seabed, the beaches, and the sea surface; (2) determining the sources of these materials and the associated pathways and mechanisms of transport in the marine environment; (3) understanding the fate of these forms of litter, particularly the persistence of these materials in marine areas; and (4) assessing the impacts of these materials on marine organisms and on recreational and commercial users of the sea. (See also W79-10049) (Sinha-OEIS)
W79-10053

MICROORGANISMS,
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 5C.
W79-10055

5C. Effects Of Pollution

A STUDY OF THE REUSE OF REUSED WATER,
Construction Engineering Research Lab. (Army), Champaign, IL.
For primary bibliographic entry see Field 3C.
W79-09846

EFFECT OF SELENIUM DIOXIDE ON THE ACCUMULATION AND ACUTE TOXICITY OF MERCURIC CHLORIDE IN GOLDFISH,
South Dakota Univ., Vermillion. Dept. of Biology.
J. F. Heisinger, C. D. Hansen, and J. H. Kim.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 3, p 279-283, 1979. 1 fig, 3 tab. 13 ref.

Descriptors: *Environmental effects, *Water pollution, Mercury, Fish, Toxicity, Selenium, Antagonism.

Even though whole body accumulations of total mercury were increased in goldfish which had been exposed to selenium dioxide and mercuric chloride, it was found that the acute toxicity of the mercuric chloride was decreased by the presence of the Se. At approximately equimolar concentrations of Se and Hg, maximum binding of Hg to fish occurred. At higher Se concentrations, this binding was reduced. It was also found that the greater the Hg accumulation the greater was the ability to survive a given environmental Hg concentration. (Chilton-ORNL)
W79-09901

THE EFFECT OF TEMPERATURE ON COPPER TOLERANCE OF PARAMECIUM,
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
C. Szeto, and D. Nyberg.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, No. 1/2, p 131-135, 1979. 2 tab, 9 ref. NSF DEB 76-00126.

Descriptors: *Environmental effects, *Water pollution, Temperature, Copper, Toxicity, Protozoa, Paramecium tetraurelia.

Paramecium tetraurelia were exposed to varying copper concentrations at temperatures of 12, 20, 27, and 34 C. Results showed that copper tolerance of the paramecium decreased with increased temperatures over the range studied. It was concluded that copper toxicity to some organisms can be considerably modified by other environmental parameters. (Chilton-ORNL)
W79-09903

A MORPHOLOGICAL DEFECT IN SHINER PERCH RESULTING FROM CHRONIC EXPOSURE TO CHLORINATED SEA WATER,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Researc Lab.
T. O. Thatcher.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, No. 4/5, p 433-438, 1979. 1 fig, 1 tab, 12 ref. DOE EY-76-C-06-1830.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Perches, Sea water, Morphological defect, Defect.

During the course of an investigation designed to determine the effects of chlorinated sea water on the growth of shiner perch, a morphological defect to one eye was observed in 17 of 20 young shiner perch. The defect was absent in controls. Behavioral aberrations appeared to be associated with the defect. Fish with severe cases were unsuccessful at feeding and at avoiding capture by dip-net. Fish which died during the experiment varied in the degree of severity of the observable morphological aspects of the defect. (Chilton-ORNL)
W79-09907

EFFECTS OF TEMPERATURE AND COLD STORAGE ON DEVELOPMENT TIME AND VIABILITY OF EGGS OF THE BURROWING MAYFLY HEXAGENIA RIGIDA (EPHEMEROPTERA: EPHEMERIDAE),
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
M. K. Friesen, J. F. Flannagan, and S. G. Lawrence.
The Canadian Entomologist, Vol. 111, No. 6, p 665-673, June 1979. 7 fig, 1 tab, 24 ref.

Descriptors: *Environmental effects, *Temperature, *Storage, Embryonic growth stage, Mayflies.

Mayfly eggs were monitored to determine the effect of temperature on start, hatching rate, per cent, and hatching period. Upper temperature limit for eggs transferred directly to a constant temperature and allowed to develop there was between 32 and 36 C and the lower limit was between 8 and 12 C. Success of storage varied with temperature, length of storage period, stage of embryonic development of eggs at time of transfer, and transfer method. The combination found to be best for long-term storage (up to 52 weeks) was use of middle stage eggs stored at 8 C and transfered in a stepwise manner to (4 C every 2 days) and from (4 C every 7 days) 8 C. Eggs in middle and late stage of development could be stored for up to 16 weeks at 8 C using a direct transfer method. Short-term storage was also possible at 12 C using direct transfer method. (Chilton-ORNL)
W79-09919

ANALYSIS OF NITRATE CONTENT OF SURFACE WATER AND EFFLUENT WATER. APPLICATIONS OF A PLASTIC-MEMBRANE NITRATE-SELECTIVE ELECTRODE IN WATER QUALITY MONITORS,
Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands). Application Lab.
H. C. Brinkhoff.
Environmental Science and Technology, Vol. 12, No. 13, p 1392-1394, December 1978. 4 tab, 11 ref.

Descriptors: *Nitrates, *Effluents, *Monitoring, *Membranes, *Electrodes, *Analytical techniques, Surface waters, Methodology, Instrumentation, Colorimetry, Sewage treatment, Industrial wastes, Waste treatment, Water pollution control, Netherlands, Streams, Rivers.

Application reliability was proven for a plastic membrane nitrate-selective electrode with a quaternary ammonium salt as the ion-selective species as a means of determining nitrate contents of aerobic surface water and sewage treatment plant effluents. Under aerobic conditions only interference by chloride should be expected, with a probable deviation of under 10%. An advantage of plastic membranes is that sample pretreatment is not required. The electrode was successfully used for three months in continuous on-site analysis in two water quality monitors, Phillips models PW 9835 and WQM. Water flow at the membrane was kept at 1.5-2.0 m/sec to reduce membrane fouling, and electrodes in the PW 9835 were ultrasonically cleaned every half hour for one minute. The membrane electrode system compared favorably with a standard colorimetric method in laboratory testing. Electrodes tested were the nitrate-selective Philips IS-561-NO3 and the double-junction electrode RH44 D/2-GD/L1/SL. The reference liquid membrane electrode had 3 mol/L KCl and 0.1 mol/L MgCl2 as internal filling solutions. For colorimetric analysis a modified standard procedure was followed in which nitrate was reduced to nitrite, subsequently measured by a diazotation reaction. Laboratory tests used surface water samples from three streams (Dutch), Aa, Dommel, and Maas. (Lynch-Wisconsin)
W79-09920

AUTOTROPHY IN STREAM ECOSYSTEMS,
Idaho State Univ., Pocatello. Dept. of Biology.
G. W. Minshall.
Bioscience, Vol. 28, No. 12, p 767-771, December 1978. 2 fig, 4 tab, 46 ref.

Descriptors: *Autrotrophy, *Streams, *Deep Creek(ID), *Organic matter, *Primary productivity, *Nutrients, Lotic environment, Biological communities, Ecology, Heterotrophy, Life cycles, Biorhythms, Idaho, Macrophytes, Periphyton, Litter, Leaves, Deciduous forests, Respiration, Energy, Nutrient loading, Carbon.

Evaluation of data on several streams in a variety of vegetational environments shows that the hypothesis that streams are heavily dependent on allochthonous inputs of organic matter has been overemphasized. In many cases autotrophy is of primary importance in maintaining the structure and function of lotic communities, though supportive evidence is limited mostly because most studies have concentrated on small streams in deciduous forest areas where the importance of external organic matter is the predominant feature. Many conclusions of this paper are based on research in Deep Creek in southern Idaho, a productive hardwater stream whose streamside vegetation is dominated by sagebrush and grass. Allochthonous contributions of organic matter are trivial, and autotroph supply most energy sources for the diverse and productive community. Comparative data for several other streams show: (1) Animal diversity and productivity and community stability in autotrophic streams are comparable to heterotrophic

ones. (2) Unpolluted streams are not necessarily predominantly heterotrophic as has been believed. (3) Synchronization of life cycle phenomena among benthic invertebrates does not necessarily depend on autumnal inputs of external leaf material. In a number of the streams autotrophic production is the major or sole source of fixed carbon in the system, and even in heterotrophic streams primary production plays a fairly important role in stream economy. (Lynch-Wisconsin)
W79-09922

EXCHANGE OF CERTAIN RADIONUCLIDES BETWEEN THE ENVIRONMENT AND FRESH-WATER ALGAE,
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany.
E. D. P. Marchyulenene.
The Soviet Journal of Ecology, Vol. 9, No. 2, p 163-165, March-April 1978. Translated from Ekologiya, No. 2, p 80-81, March-April 1978. 1 tab, 3 ref.

Descriptors: *Algae, *Radioisotopes, *Absorption, *Ion exchange, *Charophyta, *Cladophora glomerata, Nitella syncarpa, Nitellopsis obtusa, Chara rudis, Chara vulgaris, Strontium, Cesium, Cerium, Ruthenium, Bioaccumulation, Chuvintas Lake(U.S.S.R.), Dusya Lake(U.S.S.R.), Seasonal, Colloids, Durshyu-Mares Bay(U.S.S.R.).

Levels of both accumulation and elimination of radionuclides by freshwater algal species of Charophyta and Cladophora depended on the chemical nature of the radionuclides and on the algal species in tests with samples from Chuvintas and Dusya lakes and Kurshyu-Mares Bay, U.S.S.R. Accumulation of strontium, cesium, cerium, and ruthenium was tested with Cladophora glomerata, Nitella syncarpa, Nitellopsis obtusa, Chara rudis, and C. vulgaris. Radionuclides were introduced in the form of chlorides at 0.00001 Ci/l, and water and algal samples were examined after three hours, and 1, 2, 4, 8, and 16 days. Intensity and level of accumulation of the radionuclides were extremely varied, and were representable by the series Ce-144 > Ru-106 > Sr-90 > Cs-137. Results indicate radionuclides of the tri- and tetravalent metals cerium and ruthenium, which exist in aqueous medium primarily in a colloidal state and enter aquatic plants chiefly by absorption, are accumulated more intensively and in larger amounts than radionuclides of cerium and strontium, which exist in the aqueous phase in an ionic state and enter aquatic plants by ionic exchange. The higher levels of accumulation of strontium-90 than of cesium-137 can be explained by preferential accumulation of calcium in the algae compared to the larger relative surface/unit wt, and to its adaptation to fluctuations in water mineral composition due to discharge of Baltic Sea waters into Kurshyu-Mares Bay. (Lynch-Wisconsin)
W79-09923

AN ECOPHYSIOLOGICAL STUDY OF THE MEIOFAUNA OF THE SWARTKOPS ESTUARY. 3. PARTITION OF BENTHIC OXYGEN CONSUMPTION AND THE RELATIVE IMPORTANCE OF THE MEIOFAUNA,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
A. H. Dye, T. Erasmus, and J. P. Furstenberg.
Zoologica Africana, Vol. 13, No. 2, p 187-199, 1978. 4 fig, 3 tab, 34 ref.

Descriptors: *Swartkops Estuary(South Africa), *Meiofauna, *Nematodes, *Oxygen demand, *Benthic fauna, *Beaches, Sands, Mud flats, Ecology, Respiration, Metabolism, Secondary productivity, South Africa, Light-dark bottle method, Prawns, Callianassa draussi, Crustaceans, Microorganisms, Productivity, Temperature.

Measurement of benthic oxygen demand at a sand and a mud beach in the Swartkops Estuary near Port Elizabeth, South Africa, showed that meiofauna in these exposed areas are not quantitatively important, but may be significant qualitatively. Secondary production, measured by the light-dark bottle technique, was 82 g C/sq m/yr in sandy areas, and 863 g in muddy areas rich in the prawn Callianassa kraussi. Meiofauna production was 2.1% in sandy areas and 0.03% in the mud flats. Microorganisms accounted for the largest share of secondary production, 92% in sand and 75.5% in mud, while macrofauna accounted for 5.75% and 24.4% in the two areas. Determination of respiration rates of individual species was not attempted. Nematodes were dominant among meiofauna in both areas and so were chosen for meiofaunal respiration determinations by a polarographic micro-respirometer method. Meiofauna was extracted from the sand by the decanting technique, 50 nematodes of mean mass 0.43 microg were placed in a drop of artificial seawater in the respirometer, and readings were taken with the oxygen probe at 10, 20, and 30 C. Metabolic activity increased with temperature. Individuals from the sand beach increased in metabolic rate from 1.39 microl 02/mg ash-free dry wt at 10 C to 3.03 microl at 30 C, while specimens from the mud flat increased from 1.53 to 7.47 microl. The difference between the two sites is probably due to differences in species composition. (Lynch-Wisconsin)
W79-09924

RESERVOIR METALIMNION OXYGEN DEMANDS: DISCUSSION,
Cornell Univ., Ithaca, NY. Dept. of Civil and Environmental Engineering.
R. I. Dick, and C. A. Cairns.
Journal of the Environmental Engineering Division of the American Society of Civil Engineers, Vol. 105, No. 1, p 177-179, February 1979. 1 fig, 3 ref.

Descriptors: *Metalimnion, *Reservoirs, *Settling velocity, *Sedimentation rates, *Water temperature, *Oxygen demand, Particulates, Organic matter, Specific gravity, Density, Viscosity, Suspended solids.

The dramatic effect of temperature on particle sedimentation velocity proposed by Gordon and Skelton in 'Reservoir Metalimnion Oxygen Demands' (See W78-04202) as being responsible for the accumulation of oxygen-demanding particulate organics in a reservoir metalimnion is possible only if the specific gravity of the settling particles is 1.00, as is assumed by the authors. With particles of mass densities even as low as 1.01 g/ml the mechanism proposed is far less significant. Thus if this mechanism does in fact explain the distribution of organic particles in reservoirs, then the particle density must be nearly equal to that of water, and certainly less than 1.01 g/ml. Water temperature affects sedimentation rates because of its effect on water viscosity and density. Whereas the effect is usually greater on viscosity than on density, under circumstances considered in the article the reverse is true because the difference between the mass density of the settling particles and the mass density of the water is the factor influencing sedimentation rate, and because particles were assumed to have a specific gravity of only 1.00. An illustration is given using data for another reservoir. Other studies have reported average densities of algal cells at 1.089 g/ml, protozoan cysts at 1.057 g/ml, various organisms at 1.02-1.15, and living plankton protoplasm at about 1.05 g/ml. (Lynch-Wisconsin)
W79-09925

LOCAL AND MESOSCALE INFLUENCES ON NUTRIENT VARIABILITY IN THE NORTHWEST AFRICAN UPWELLING REGION NEAR CABO CORBEIRO,
Washington Univ., Seattle. Dept. of Oceanography.
L. A. Codispoti, and G. E. Friederich.
Deep Sea Research, Vol. 25, No. 9, p 751-770, September 1978. 14 fig, 2 tab, 47 ref.

Descriptors: *Upwelling, *Nutrients, *Cabo Corbeiro(Spanish Sahara), *Atlantic Ocean, *Winds, Spanish Sahara, Oceans, Nitrates, Ammonia, Phosphorus, Primary productivity, Advection, Continental shelf, Turbidity, Catobolism, Coasts, Meteorology, Hydrography, Silicon, Topography, Distribution, Cycles.

Much of the nutrient variability recorded during cruises of the R. V. Atlantis 11 March-May 1974 as part of the JOINT-1 experiment in the northwest African upwelling system off Cabo Corbeiro, Spanish Sahara, can be related to data obtained within the region rather than to large-scale processes. Local wind variations and hydrographic cycles were particularly important. Five periods of enhanced upwelling 'events' previously identified in the region help explain the data, and some of the remaining variability can be related to temporal changes in primary production, variations in cross-shelf flow, and interaction of the advective field with a longshore nutrient gradiant. Mesoscale observations made it possible to explain an anomalously high ammonia concentration over the inner shelf. A net transport of organic material into this region may have occurred, and high nearshore turbidity reduced primary production rates; these factors apparently enabled community catobolism to produce ammonia faster than it could be consumed. The general nature of the nutrient distributions near Cabo Corbeiro is probably affected by topographic features such as an undersea canyon about 30 km to the north, and by large-scale processes that could for example, alter the position of the front between North Atlantic Central Water and South Atlantic Central Water. Internal waves and spatial differentiation could also complicate the interpretation. (Lynch-Wisconsin)
W79-09926

BUDGETS OF SELECTED NATURAL MINERAL NUTRIENTS FOR A SOUTHEASTERN PIEDMONT FOREST AND PASTURE,
Georgia Univ., Athens. Inst. of Natural Resources.
J. E. Krebs.
Ph D Dissertation, June 1977, 125 p, 15 fig, 75 tab, 78 ref, 1 append.

Descriptors: *Watersheds(Basins), *Ecosystems, *Forest watersheds, *Pastures, *Nutrient budgets, Nutrients, Cycling nutrients, Georgia, Bishop F. Grant Memorial Forest(GA), Central Georgia Branch Experiment Station(GA), Land management, Streams, Sediments, Piedmont, Cattle, Water pollution sources, Agricultural runoff, Soil types, Precipitation(Atmospheric), Hydrology, Sodium, Potassium, Calcium, Lead, Iron, Magnesium.

A comparison of mineral nutrient budgets 1974-76 for two Georgia piedmont watershed ecosystems, a mixed pine-hardwood forest and a pasture for brood cows, showed that: (1) ecosystems maintained at early succession stages such as pastures lose larger quantities of nutrients than successional forest communities; (2) a mixed pine-hardwood ecosystem is accumulating most essential nutrients, suggesting continuing increase in biomass; and (3) even the forest piedmont stream does not meet EPA water quality criteria for all elements. In the latter iron and manganese ranges too high for domestic use, and iron, manganese, and phosphorus for domestic and irrigation use, as well as for most aquatic life. The forest ecosystem is in the Bishop F. Grant Memorial Forest, and the pasture is at the Central Georgia Branch Experiment Station, Eatonton, Georgia. The 40-ha forest was a cotton field until the early 1920s, then was allowed to return to forest. The 10-ha pasture was formerly a peach orchard, but has been a pasture for 25 yrs. Forest soils composition are Mecklenburg (24%), Cecil (17%), Iredell (13%), Appling (13%), and Hiwassee (11%). Pasture soils are in the Cecil and Davidson series. The two watersheds show very similar patterns of the elements studied; both accumulate cadmium, chromium, copper, potassium, phosphorus, lead, and zinc, and both lose aluminum, calcium, cobalt, manganese, and sodium. The only exception is magnesium, accumulated in the pasture and lost in the forest. (Lynch-Wisconsin)
W79-09927

EFFECTS OF CALCIUM ADDITION AS CA(NO3)2 ON ZINC TOXICITY TO FATHEAD MINNOWS, PIMEPHALES PROMELAS, RAFINESQUE,
North Texas State Univ., Denton. Dept. of Biological Sciences.
R. D. Judy, Jr., and P. H. Davies.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 1/2, p 88-94, 1979. 2 fig, 3 tab, 14 ref.

Descriptors: *Environmental effects, *Water quality, Toxicity, Zinc, Calcium, Fish, Chemical interaction, Antagonism, Fathead minnows, Pimephales promelas.

The role which calcium plays in inhibition of zinc toxicity was examined using fathead minnows as the tent organisms. It was shown that calcium in solution does inhibit the toxicity of zinc to these organisms. The physiological interactions of calcium and zinc have not been investigated and it was suggested that long-term testing needs to be done on this problem. Water quality criteria for safe zinc levels are affected by the antagonistic influence of calcium to the toxicity of zinc. (Chilton-ORNL)
W79-09928

REDUCTION OF BLOOD PLASMA COPPER CONCENTRATIONS IN A MARINE FISH FOLLOWING A SIX MONTH EXPOSURE TO CRUDE OIL,
Memorial Univ. of Newfoundland, St. John's. Marine Sciences Research Lab.
G. L. Fletcher, J. W. Kiceniuk, M. J. King, and J. F. Payne.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, p 548-551, 1979. 1 tab, 12 ref.

Descriptors: *Environmental effects, *Water pollution, Oil, Fish, Copper, Blood plasma.

Cunner (Tautogolabrus adspersus) were continuously exposed to a surface slick of Venezuelan crude oil for six months. Examination of blood plasma at the end of this period showed that copper concentrations were significantly lower in oil exposed female cunner than in controls. The few values obtained for males were similar. Plasma Ca, Mg, Zn and total proteins did not differ significantly between fish exposed to oil and controls. (Chilton-ORNL)
W79-09931

INFLUENCES OF HARDNESS CONSTITUENTS ON THE ACUTE TOXICITY OF CADMIUM TO BROOK TROUT (SALVELINUS FONTINALIS),
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
J. J. Carroll, S. J. Ellis, and W. S. Oliver.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, p 575-581, 1979. 3 tab, 11 ref.

Descriptors: *Environmental effects, *Water pollution, Cadmium, Mortality, Trout, Calcium, Protection, Toxicity.

These investigations were designed to determine the contribution of each of several components of hardness to the protection of brook trout against cadmium toxicity. From LC50 data obtained in different test waters, it is clear that calcium ion is very protective while magnesium, sodium and sulfate ions and the carbonate system give little or no protection. While precipitation may have influenced LC50 values slightly, it was concluded that the influence could not have been great because precipitation amounted to no more than about 40% of the cadmium present. No precipitation was detected at 15 microg/l nominal concentration, a level at which 90 to 100% mortality was observed in waters low in calcium but at which little or no mortality was observed in waters high in calcium. (Chilton-ORNL)
W79-09932

TRACE METAL UPTAKE BY THREE SPECIES OF MOLLUSKS,
National Marine Fisheries Service, Milford, CT. Milford Lab.
R. A. Greig.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, p 643-647, 1979. 3 tab, 7 ref.

Descriptors: *Environmental effects, *Water pollution, Absorption, Silver, Cadmium, Copper, Clams, Oysters, Ocean quahogs.

This study examines the uptake of silver, cadmium, and copper by ocean quahogs, surf clams, and oysters when they were exposed to all metals simultaneously. The oyster took up all metals to a greater extent than either the quahog or surf clam. Surf clams took up nearly as much silver as did oysters, especially at 20 ppb exposure level. Ocean quahog took up an amount of silver similar to the amount it took up of copper. (Chilton-ORNL)
W79-09933

LABORATORY STUDIES ON THE DIRECT EFFECT OF TEMPERATURE ON THE FRESHWATER VECTOR SNAIL, INDOPLANORBIS EXUSTUS (DESHYES),
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
D. P. Vaidya, and R. Nagabhushanam.
Hydrobiologia, Vol. 61, No. 3, p 267-271, 1978. 4 fig, 1 tab, 19 ref.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Snails, Embryonic growth stage, Mature growth stage, Growth rates, Hatching, Incubation, Mortality.

Lower lethal temperature for young snails was found to be 7.0 C and for adult snails, 7.5 C. Upper lethal temperature was 34.0 C for young and 32.0 C for adult snails. Lower lethal temperature of embryos was about 10.0 C and the upper lethal temperature was about 36.5 C. Within these extremes hatching rates showed no considerable differences but embryonic development was accelerated and the incubation period shortened as the water temperature rose. Incubation period for eggs ranged from 25 days at 15.0 C to 7 days at 35.0 C. Growth rate of embryos reached a maximum at 25.0 C. This was also the optimum temperature for egg laying. (Chilton-ORNL)
W79-09934

MERCURY CONTAMINATION OF FISH IN GUATEMALA,
Unified Food Control Lab., Guatemala City.
A. Ramos, M. de Campos, and A. E. Olsyna-Marzys.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, 1979, p 488-493. 3 tab, 9 ref.

Descriptors: *Environmental effects, *Water pollution, Mercury, Fish, Guatemala, Shellfish, Absorption.

214 specimens of 19 species of finfish and 89 specimens of 4 classes of shellfish were analyzed for mercury contamination. Results of the analyses showed that mercury contamination of finfish and shellfish in Guatemala does not present a big problem even though a few samples had high residue levels. It was recommended that local fish should be analyzed regularly for mercury contamination. (Chilton-ORNL)
W79-09939

THE DEVELOPMENT OF THE EGGS AND EARLY LARVAE OF BLUE WHITING, MICROMEISISTIUS POUTASSOU, AND THE EFFECT OF TEMPERATURE ON DEVELOPMENT,
Institute for Marine Environmental Research, Plymouth (England).
S. H. Coombs, and A. R. Hiby.
Journal of Fish Biology, Vol. 14, No. 1, p 111-123, January 1979. 5 fig, 4 tab, 30 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Temperature, Embryonic growth stage, Hatching, Larvae, Mortality, Fish, Blue whiting, Micromesistius poutassou.

Blue whiting eggs were artificially fertilized and incubated at temperatures ranging from 1 to 18 C. Rate of embryonic development was found to increase with increasing temperature. Time from fertilization to hatching decreased from 205 h at 6 C to 70 h at 15 C. Optimal survival rate of 70% was seen between 6 and 10 C. The upper limit for successful development of blue whiting eggs was found to be about 14.5 C. The lower limit was not established because of the long incubation times but it was estimated that successful hatching does not occur under natural conditions below 5 C. (Chilton-ORNL)
W79-09942

AN INVESTIGATION OF PLUTONIUM CONCENTRATION AND DISTRIBUTION IN A BURROWING CRAYFISH FROM THE WHITE OAK CREEK FLOODPLAIN,
Oak Ridge National Lab., TN.
M. S. Delaney, R. C. Dahlman, and R. B. Craig.
Available from the National Technical Information Service, Springfield, VA 22161 as ORNL/TM-6702, Price codes: A06 in paper copy, A01 in microfiche. ORNL/TM-6702. January 1979. 101 p. 9 fig, 13 tab, 60 ref, 4 append.

Descriptors: *Environmental effects, Plutonium, Absorption, Crayfish, Radiation, Soil contamination, Soils, White Oak Creek, Tennessee, Bioaccumulation.

The number of contaminated crayfish estimated to be at two sites on the White Oak Creek floodplain in 1977 was from 84 to 110. Average Pu239 concentrations in contaminated crayfish were more than one hundred times greater than in control crayfish. The floodplain soil surpassed background level soil by three orders of magnitude. Average Pu239 concentration in digestive tracts of contaminated crayfish was 6 to 8 times greater than in their soft tissues and 8 to 15 times greater than in their carapaces. Pu239 concentration in unfiltered water appeared to relate to that in the soft tissues. It was concluded that biomagnification with respect to soil Pu is not a concern and that estimated whole body radiation dose either to man after ingesting Pu239 in the soft tissues of ten crayfish from the White Oak Creek floodplain or to other predators is inconsequential in comparison with background radiation. (Chilton-ORNL)
W79-09943

AN EMPIRICAL MODEL OF IMPINGEMENT IMPACT,
Oak Ridge National Lab., TN.
L. W. Barnthouse, D. L. DeAngelis, and S. W. Christensen.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG-CR0639, Price codes: A02 in paper copy, A01 in microfiche. NUREG/CR-0639; ORNL/NUREG/TM-290. February 1979. 20 p. 3 tab, 16 ref.

Descriptors: *Environmental effects, *Model studies, Mortality, Populations, Juvenile fish, Powerplants, Impingement.

The model described in this paper can be used to estimate the impact of impingement of juvenile fish by power plants on year-class abundance in vulnerable species. In the model, the impact of impingement is expressed as the conditional mortality rate and the data required are estimates of initial number of impingeable juveniles, number impinged, and rate of total mortality during the period of vulnerability. Conditional mortality rate is said to be superior to exploitation rate as a measure of impact because it accounts for the differential impact of impinging fish of different ages and it is numerically equivalent to the fractional reduction in year-class abundance due to impingement. An application of the model is presented using the 1974 year-class of the Hudson River striped bass population as an example. (Chilton-ORNL)
W79-09944

THERMAL BEHAVIORAL RESPONSES OF THE SPECKLED SANDDAB, CITHARICHTHYS STIGMAEUS: LABORATORY AND FIELD INVESTIGATIONS,
Occidental Coll., Los Angeles, CA. Dept. of Biology.
K. F. Ehrlich, J. S. Stephens, G. Muszynski, and J. M. Hood.
Fishery Bulletin, Vol. 76, No. 4, p 867-872, 1979. 4 fig, 2 tab, 17 ref.

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Descriptors: *Environmental effects, *Thermal stress, Temperature, Fish, Distribution, Laboratory tests, On-site investigations, California, Speckled sanddabs, Citharichthys stigmaeus.

The effects of acclimation temperature, size and sex of speckled sanddabs on their temperature selection was examined. Sanddabs were collected from King Harbor, Redondo Beach, California, an area which receives thermal effluent as well as cold upwelled water. Peak abundance of sanddabs in King Harbor occurred from winter through spring and early summer when bottom temperatures were low. During late summer and fall breakdown of stratification, warm bottom water was associated with a pronounced decrease in the number of fish. A high correlation between field observations and temperatures selected in the laboratory indicates that field distribution may be explained by temperature. Laboratory data also indicated that the water in King Harbor is usually warmer than that preferred by sanddabs and that they may be under stress and more susceptible to infection in the area. (Chilton-ORNL)
W79-09945

THERMAL BEHAVIORAL RESPONSES OF SELECTED CALIFORNIA LITTORAL FISHES,
Occidental Coll., Los Angeles, CA. Dept. of Biology.
K. F. Ehrlich, M. J. Hood, G. Muszynski, and G. E. McGowen.
Fishery Bulletin, Vol. 76, No. 4, p 837-849, 1979. 7 fig, 1 tab, 47 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Temperature, Fish behavior, Fish, Littoral, California, Temperature.

Two horizontal temperature gradients (one for juveniles and adults and another for larvae) were used to measure behavioral responses to temperature of 16 species of temperate marine fish. Behavioral responses were classified using eight environmental parameters: initial, mean, modal, and final selected temperatures; ranges of selected temperatures; skewness; kurtosis; and the degree of dispersion between individuals. It was found that the effects of preexperimental acclimation temperatures influenced selection temperatures for only about 4 hr. A day of food deprivation caused fish to select lower temperatures and also changed the precision of selection and aggregating tendencies. The direction of this change varied between species. (Chilton-ORNL)
W79-09946

EFFECTS OF SUDDEN TEMPERATURE SHIFTS ON PURE CULTURES OF FOUR STRAINS OF FRESHWATER BACTERIA,
Konstanz (Germany, F.R.), Limnolog Inst.
M. G. Hofle.
Microbial Ecology, Vol. 5, No. 1, p 17-26, 1979. 7 fig, 2 tab, 20 ref.

Descriptors: *Environmental effects, *Temperature, Bacteria, Growth rates, Freshwater.

Effects of sudden temperature increases on growth rates and substrate conversion in Cytophaga johnsonae, Cytophaga sp., Pseudomonas fluorescens, and Enterobacter cloacae were investigated. Growth rate in the shift-up cultures from 5 to 10 C decreased for Cytophaga sp., remained the same for C. johnsonae, and increased for P. fluorescens in comparison to 10 C basic culture. Substrate conversion increased in all cases immediately after shift-up. The extracellular substrate conversion of glucose to gluconate and 2-ketogluconate by P. fluorescens was particularly affected by sudden temperature increase. (Chilton-ORNL)
W79-09948

EFFECT OF A STEAM ELECTRIC GENERATING STATION ON THE EMERGENCE TIMING OF THE MAYFLY, HEXAGENIA BILENEATA,
Oak Ridge National Lab., TN.
J. S. Mattice, and L. L. Dye.
Verh. Internat. Verein. Limnol., Vol. 20, p 1752-1758, November 1978. 4 fig, 1 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Electric power, Thermal powerplants, Growth stages, Mayflies, Emergence.

Emergence of mayflies were observed at three areas of study near a steam electric generating plant; the intake canal, a reference cove, and the discharge cove. In the discharge cove, a thermocline develops in spring and remains until fall. The other areas are unstratified. Water temperatures in the three areas follow typical seasonal trends of a temperate area except that the discharge cove temperature above the thermocline averaged 5 C higher than intake canal and 3.1 C higher than reference cove. Below the thermocline discharge water temperature was similar to intake water temperature. Data from traps in each cove indicated that emergence timing in the intake and reference sites were not significantly different but the discharge site was significantly earlier. It was suggested that these observed differences in emergence timing are primarily a function of temperature. (Chilton-ORNL)
W79-09949

THE FRESHWATER LITTORAL MEIOFAUNA IN A SOUTH CAROLINA RESERVOIR RECEIVING THERMAL EFFLUENTS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
B. J. Oden.
Freshwater Biology, Vol. 9, p 291-304, 1979. 5 fig, 3 tab, 56 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Aquatic animals, Freshwater, Reservoirs, Cooling water, South Carolina, Populations, Density, Species diversity.

Sampling was conducted monthly from September 1975 to October 1976 at three sites in the cooling reservoir of Savannah River Plant. At the ambient site temperature ranged from 8-37 C, at a warm-water site from 13 to 37 C, and at a hot-water site from 15 to 40 C. Total numbers of individuals at the ambient site ranged from 971 to 3674/10 sq cm with nematodes, rotifers, ostracods, cladocerans and mites comprising 80% overall density. At the two thermally affected sites, density as well as species diversity were reduced. However, high equitability among the reduced species resulted in Shannon-Weaver diversity index values which were comparable to those in natural communities. Distinct winter-spring and summer-autumn assemblages were seen in the ambient community which were absent from the thermally affected sites. It was suggested that maintenance of above normal temperatures masks environmental cues which normally elicit seasonal changes. (Chilton-ORNL)
W79-09950

GROWTH, FEEDING AND MORTALITY OF LARVAL AND EARLY POSTLARVAL STAGES OF THE OCEANIC SHRIMP SERGESTES SIMILIS HANSEN,
Scripps Institution of Oceanography, La Jolla, CA.
M. Omori.
Limnology and Oceanography, Vol. 24, No. 2, p 273-288, 1979. 6 fig, 8 tab, 32 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Shrimps, Growth rates, Mortality, Feeding rates, Growth stages, Larval growth stage, Hatching.

Hatching viability, growth, mortality, and feeding of Sergestes similis reared from egg to 8th postlarval stage were investigated at temperatures of 6, 10, 14, and 18 C. Hatching viability of eggs released 12 h after capture averaged 90% at 10, 14, and 18 C but dropped to 32% at 6 C. Development rate of eggs was fastest at 18 C. Development of larvae was also slower at lower temperatures. Gross growth efficiency averaged 32% in larval and postlarval stages. Growth rates were higher in protozoeal and zoeal stages. Filtering, clearance, and ingestion rates increased with increasing body weight and with particle size. (Chilton-ORNL)
W79-09951

THE EFFECTS OF TEMPERATURE AND DIFFERENT FOOD ORGANISMS ON THE RATE OF GASTRIC EVACUATION IN PERCH (PERCA FLUVIATILIS),
Lund Univ. (Sweden). Limnological Inst.
L. Persson.
Freshwater Biology, Vol. 9, p 99-104, 1979. 3 fig, 4 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, Perches, Foods, Size, Rates, Gastric evacuation, Perca fluviatilis.

The rate of gastric evacuation in perch was studied at different seasons and at different temperatures (ranging from 4.0 to 21.7 C) with G. pulex as the principal food organisms. Rate of gastric evacuation was empirically described by an exponential function. The relation between instantaneous evacuation rate (R) and temperature was also described by an exponential function. No differences were found in evacuation rate for different size classes of fish. No significant differences were found in evacuation rate for several food organisms (Gammarus pulex, Chaoborus, chironomids and zooplankton). These results are compared with previously obtained results for other species. (Chilton-ORNL)
W79-09952

THE INFLUENCE OF SOME ECOLOGICAL FACTORS ON THE METABOLISM-TEMPERATURE CURVE OF THE LARVAE OF LIMNEPHILUS RHOMBICUS, (TRICHOPTERA, LIMNEPHILIDAE),
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animaux et Zoologie.
C. Roux.
Freshwater Biology, Vol. 9, p 111-117, 1979. 3 fig, 1 tab, 28 ref.

Descriptors: *Environmental effects, *Temperature, *Metabolism, Larvae, Adaptation, Lentic environment, Insects, Caddisflies, Limnephilus rhombicus.

Oxygen uptake of Limnephilus rhombicus was measured under three experimental conditions: (A) in still water with a plastic mesh substrate, (B) in stirred water with a plastic mesh substrate, and (C) in still water without any substrate. These measurements were compared with previously obtained data for the larvae of Micropterna testacea. Metabolism-temperature curves for L. rhombicus showed little difference between A and C except for a peak at 15 C for curve A. Larvae did not appear to be influenced by the presence or absence of substrate. Between 5 and 10 C, all three curves showed a plateau. An increase in oxygen uptake occurred between 10 and 15 C. The main difference seen between L. rhombicus and M. testacea was in their adaptation to temperature. L. rhombicus are adapted to lower temperatures and to more variable biotopes. (Chilton-ORNL)
W79-09953

EFFECTS OF WATER-SOLUBLE CHLORINE-CONTAINING ORGANICS ON AQUATIC ENVIRONMENTS--ANOTHER PERSPECTIVE,
Oak Ridge National Lab., TN.
J. R. Trabalka, and M. B. Burch.
Toxicology Letters, Vol. 3, p 201-207, 1979. 3 tab, 17 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Toxicity, Organic compounds, Chlorine, Carp, Embryonic growth stage.

Previously reported investigations indicated that 5-chlorouracil and 4-chlororesorcinol significantly lowered hatching success of carp eggs at 5 microg/l and that 5-chlorouracil delayed and reduced initial production of offspring in Daphnia magna at 10 microg/l. This paper supports more recent work which indicates that these compounds may be far less toxic. Data also indicate the toxicity of synthetic effluents can be attributed to the phenolic content, primarily to the combined toxicity of chlorophenols. (Chilton-ORNL)
W79-09954

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Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

UPPER LIMITS OF THE DEPTH RANGE AND TEMPERATURE TOLERANCE OF THE BALTIC PONTOPOREIA AFFINIS (CRUSTACEA, AMPHIPODA),
Institute of Marine Research, Helsinki (Finland). Biological Lab.
S. G. Segerstrale.
Ann. Zool. Fennici, Vol. 15, p 200-201, 1978. 1 fig, 12 ref.

Descriptors: *Environmental effects, Temperature, Distribution, Amphipods, Finland, Depth, Populations, Density, Resistance, Temperature tolerance.

This paper reports the occurrence of Pontoporeia affinis, a cold-stenothermal glacial relicit, in the Tvarminne area. In this area the amphipod has been found to occur abundantly at depths much shallower than in other studies and also at higher temperatures. In the Krogarviken locality, this amphipod tolerated about 22 C at a depth of 3 m during 4 successive days. Temperature records showed high population densities of the species in years with summer temperatures exceeding 18 and 19 C. (Chilton-ORNL)
W79-09956

CHANGES IN THE AQUATIC FLORA ALONG A STRETCH OF THE RIVER UMEALVEN, N. SWEDEN, FOLLOWING HYDROELECTRIC EXPLOITATION,
Umea Univ. (Sweden). Dept. of Ecological Botany.
C. Nilsson.
Hydrobiologia, Vol. 61, No. 3, p 229-236, 1978. 2 fig, 59 ref.

Descriptors: *Environmental effects, *Hydroelectric plants, Aquatic plants, Rivers, Sweden, Distribution, Ecological distribution, Abundance.

This study attempts to use comparative floristic analyses of the aquatic flora along a river, before and after hydro-electric work, as a measure of ecological change. The report lists 45 phanerogamic taxa which have been found in the study area. It is suggested that ecological factors such as frost action, silting, water flow and water-level amplitude have affected abundance and distribution of some species but it is doubtful that more than a few have disappeared. (Chilton-ORNL)
W79-09957

TOXICITY OF GALLIUM AND BERYLLIUM TO DEVELOPING CARP EGGS (CYPRINUS CARPIO) UTILIZING COPPER AS A REFERENCE,
Oak Ridge National Lab., TN.
S. G. Hildebrand, and R. M. Cushman.
Toxicology Letters, Vol. 2, p 91-95, 1978. 1 fig, 17 ref.

Descriptors: *Environmental effects, *Water pollution, *Analytical techniques, Toxicity, Carp, Hatching, Copper, Beryllium, Gallium, Reference element.

Carp eggs were exposed to copper, beryllium, and gallium and the percentage hatch to viable fry was used as the measure of toxicity. Concentrations of copper below 0.09 ppm and beryllium below 0.08 ppm did not reduce hatching success below the control level. Concentrations of gallium below 2.4 ppm did not reduce hatching success. No eggs hatched at concentrations above 0.7 ppm copper and 0.2 ppm beryllium. At 17 ppm gallium hatching success was completely inhibited but the data does not indicate the effect of gallium on hatching success at concentrations between 2.4 and 17 ppm. It was concluded that the technique of using hatching success as an endpoint and a reference element is a potentially useful screening tool. (Chilton-ORNL)
W79-09958

FACTORS AFFECTING THE BURROWING ACTIVITY OF MACOMA BALTHICA (L.),
Helsinki Univ. (Finland). Tvarminne Zoological Station.
J. Eldon, and R. Kristoffersson.
Ann. Zool. Fennicci, Vol. 15, p 127-131, 1978. 6 fig, 17 ref.

Descriptors: *Environmental effects, *Animal behavior, *Temperature, Size, Sediment, Salinity, Feeding rates, Cadmium, Laboratory tests, Macoma balthica, Burrowing activity.

The effects of size, water temperature, bottom quality, salinity, starvation, and cadmium exposure on the burrowing activity of M. balthica were tested under laboratory conditions. It was noted that small animals burrowed more rapidly than large ones but the reasons for this were not clear. Temperature had a clear effect on burrowing activity as evidenced by the fact that animals were more active at 16 C than at 4 C. Diminished burrowing activity was noted when specimens had been kept on a hard bottom for 2-3 days. When they were transferred to a soft bottom their burrowing was retarded. Keeping Macoma for 3 months at 14 C without food seemed to affect only the small animals which presumably have a higher metabolic rate so that starving affects them sooner. Burrowing activity was completely inhibited in animals exposed to cadmium concentrations of 2 and 5 ppm for 24 h. At 1 ppm cadmium, burrowing activity was diminished. Exposure to 0.5 ppm cadmium resulted in an increase in burrowing activity followed by a decrease. (Chilton-ORNL)
W79-09959

EFFECTS OF ARTIFICIAL RISE OF TEMPERATURE ON STAGNANT WATERS AND THEIR BIOCENOSES,
Polish Academy of Sciences, Poznan. Dept. of Agrobiology.
E. Biesladka, K. Kasprzak, and J. Kolasa.
Int. Revue ges. Hydrobiol., Vol. 63, No. 1, p 41-56, 1978. 2 fig, 1 tab, 42 ref.

Descriptors: *Environmental effects, *Temperature, *Thermal pollution, Powerplants, Aquatic organisms, Ecosystems, Populations, Biological communities.

Investigations of some components of bottom fauna (Turbellaria, Oligochaeta, Hirudinea, Coleoptera, Hydracarina) of the heated Konin lakes are reported. Results showed a decrease in number and an elimination of species with more strict thermic and oxygen requirements, an increase in number and abundance of more eurytopic forms and an appearance as well as quantitative progress of thermophilous species. Hydracarina exhibited a multiplication in the number of generations as a result of temperature increase. Three kinds of adaptations may be distinguished on the individual and population levels: pseudoadaptations, translocation of potentially affected populations beyond heated water influence; physiological adaptations, rebuilding of physiological processes; and phenological adaptations, changing of seasonal cycles to suit new conditions. The newly formed biocenosis is markedly different from the aboriginal one. (Chilton-ORNL)
W79-09960

INFILTRATION AS INFLUENCED BY IRRIGATION WATER QUALITY,
Science and Education Administration, Riverside, CA. Salinity Lab.
J. D. Oster, and F. W. Schroer.
Soil Science Society of America Journal, Vol. 43, No. 3, p 444-447, May-June 1979. 2 fig, 3 tab, 11 ref.

Descriptors: *Infiltration, *Water quality, *Soil water, *Irrigation water, Salinity, Soils, Loam, Hydraulic conductivity, Sodium, Calcium carbonate, Cation exchange, Cations, Chemical properties, Physical properties, Soil properties, Sampling, Laboratory tests, Heimdal loam.

After 19 months of irrigation with waters of different quality, columns of Heimdal loam cropped to alfalfa had infiltration rates that were correlated better with irrigation water sodicity and salinity than with soil surface (0-76 mm) or column average (0-530 mm) exchangeable sodium and soil salinity. Two sets of irrigation water parameters were tested: (1) total cation concentration (C sub c) in mol sub c/cu m (meq/l) and sodium adsorption ratio (SAR sub c) of the irrigation water in equilibrium with solid phase $CaCO_3$ at a PCO_2 of 0.07% based on ion activities corrected for ion pairing; and, (2) total cation concentration of the irrigation water as prepared, and the adjusted sodium adsorption ratio based on the calculated pH of the water in equilibrium with $CaCO_3$. On the basis of multiple linear regression analyses, the best correlation was obtained with the lime-equilibrated water parameters (R sq = 0.87). The corresponding relationship between infiltration rate (I) in mm/hour and the chemical parameters was I = 6.80 - 1.10 SAR sub c + 0.79 C sub c. Cation concentration greatly affected infiltration rates, even at low SAR levels (2 less than SAR less than 5). Apparently, the mechanical action of the applied water greatly enhances the effects of exchangeable sodium and soil solution concentration on swelling and dispersion at the soil surface which, in turn, has a large effect on infiltration rates. (Humphreys-ISWS)
W79-09989

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13C: HYGIENIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10008

TRANSIENT EFFECTS OF OCEAN WASTEWATER SLUDGE DUMPING,
National Marine Fisheries Services Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
A. F. J. Draxler.
Journal Water Pollution Control Federation, Vol. 51, No. 4, p 741-748, April 1979. 5 fig, 18 ref.

Descriptors: *Waste water disposal, *Sludge disposal, *Water pollution effects, Environmental effects, New York, New Jersey, *Outer Continental Shelf, New York bight, Ocean dumping.

Wastewater sludge from the New York metropolitan area is barged to a site approximately 22-km equidistant between Long Island, New York and Sandy Hook, New Jersey where it is dumped in water 29-m deep. The sludge contains approximately 5% solids, which are 55% organic material and has a large nutrient and heavy metal content. The purpose of these experiments was to investigate the dynamic processes that follow a single sludge dump: the settling of particulates, the dilution of nutrients, and the changes in oxygen concentration of the receiving water (Sinha-OEIS)
W79-10029

MONITORING THE TEMPORAL DISPERSION OF A SEWAGE SLUDGE PLUME,
National Aeronautics and Space Administration, Langley Station. Langley Research Center.
R. W. Johnson, R. M. Glasgow, I. W. Duedall, and J. R. Proni.
Photogrammetric Engineering and Remote Sensing, Vol. 45, No. 5, p 763-768, June 1979. 7 fig, 3 tab, 8 ref.

Descriptors: *Monitoring, *Sewage disposal, *Sewage sludge, *Water pollution, *Suspended solids, Remote sensing, Environmental effects, Dispersion, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Plumes.

Sewage sludge from the Metropolitan New York City area is dumped in the apex of the New York Bight. Possible environmental effects due to this dumping are being studied. Results of a joint National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and State University of New York (SUNY) experiment on July 15, 1976, indicate remotely sensed monitoring and data analysis techniques may be used to study temporal dispersion characteristics of plumes resulting from dumping of sewage sludge. Remotely sensed data

were collected by multispectral scanner and photography from a NASA aircraft platform. Multiple fights were made over the plume from a spot dump (rapid discharge from a stationary barge) at about 15 min. intervals for two hours after the dump, which was made at 10 A.M. (local time). Afternoon flights over the dump area indicated that the plume was well dispersed by about five hours after the dump. Concurrent sea-truth measurements were made from NOAA and SUNY ships in and around the dump plume. Concentrations of suspended solids in the plume were correlated with multispectral scanner radiance data to obtain a regression equation which was then used to map quantitative distributions of suspended solids in the plume. For the spot dump monitored, reflected radiances from the surface waters reached peak values about 45 minutes after the dump. After this time, spectral analysis indicated that the calibrated equation could be applied. The plume was dispersed within about five hours. (Sinha-OEIS)
W79-10030

ECOLOGICAL AND PHYSIOLOGICAL/TOXICOLOGICAL EFFECTS OF PETROLEUM ON AQUATIC BIRDS. A SUMMARY OF RESEARCH ACTIVITIES FY 76 THROUGH FY 78,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
L. F. Stickel, and M. P. Dieter.
U.S. Fish and Wildlife Service, Biological Services Program Report No. FWS/OBS-79-23, July 1979. 16 p, 3 fig, 7 tab, 9 ref, 2 append.

Descriptors: *Birds, *Oil pollution, *Water pollution effects, *Toxicity, Aquatic animals, Ecology, Physiology, Oil spills, Great Lakes, *Outer Continental Shelf, Petroleum development, Aquatic birds.

The physiological and ecological effects of oil on waterbirds were examined in a series of laboratory and field experiments. Chemical methodology was developed in support of these studies. Research conducted from 1 July 1975 to 30 September 1978 by the U.S. Fish and Wildlife Service (FWS) about the effects of petroleum on aquatic birds is summarized. The following assessments were made: effects of oiling on hatchability of eggs; effects of oil ingestion on physiological condition and survival of birds; effects of oil ingestion on reproduction in birds; accumulation and loss of oil by birds; and development of analytical methods for identification and quantification of oil breakdown products in tissues and eggs of ducks. (Sinha-OEIS)
W79-10031

DISTRIBUTION AND ABUNDANCE OF SOME EPIBENTHIC INVERTEBRATES OF THE NORTHEASTERN GULF OF ALASKA WITH NOTES ON THE FEEDING BIOLOGY OF SELECTED SPECIES,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, and S. C. Jewett.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 1-74, March 1979. 12 fig, 14 tab, 48 ref, append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Benthos, *Invertebrates, *Baseline studies, *Water pollution effects, Resources development, Oil pollution, Bioindicators, Environmental effects, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

The intensive trawl study considered in this report delineates the major epifauna on the northeastern Gulf of Alaska shelf. The information obtained on faunal composition and abundance in this investigation now represents a general data base to which future changes can be compared. Long-term studies on life histories and trophic interactions should ultimately define functional aspects of communities and ecosystems vulnerable to environmental damage, and should help determine rates at which damaged environments can recover. The trawl survey was effective, and excellent spatial coverage was obtained. One hundred and thirty-three (133) stations were successfully occupied. Taxonomic analysis delineated 9 phyla, 19 classes, 82 families, 124 genera, and 168 species of invertebrates. Mollusca, Arthropoda (Crustacea), and Echinodermata dominated in species representation with 47, 42, and 36 species taken, respectively. The same phyla dominated in biomass, with Arthropoda contributing 71.4% of the total, Echinodermata with 19%, and Mollusca with 4.6%. The snow crab, Chionoecetes bairdi, contributed 66.2% of the total epifaunal invertebrate biomass. Other arthropods of significant biomass were the pink shrimp, Pandalus borealis, and the box crab, Lopholithodes foraminatus. Benthic invertebrates are useful as indicator species for a disturbed area because they tend to remain in place, typically react to long-range environmental changes and generally reflect the nature of the substratum. (Sinha-OEIS)
W79-10033

FINFISH RESOURCE SURVEYS IN NORTON SOUND AND KOTZEBUE SOUND,
Alaska Dept. of Fish and Game, Anchorage.
L. H. Barton.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 75-313, March 1979. 85 fig, 55 tab, 48 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Water pollution effects, Oil pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Finfish, Petroleum development, Fishery surveys.

An evaluation of the subsistence use of Pacific herring and other fishery resources to coastal residents in Norton Sound and Kotzebue Sound is given. Contamination of important spawning, rearing and/or overwintering areas from petroleum related activities could destroy one or more year classes, resulting in either a general weakening and decline in populations or possible elimination of an entire population, depending upon the severity and extent of pollution. Some concerns related to petroleum exploration and development and the potential impact of oil spills on the fishery resources throughout the study area are discussed. A major concern is the absence of data on distribution, relative abundance, range, age structures, etc. of fishery resources during the ice covered months. A second concern is the lack of information available on fishery resources which utilize the Yukon River Delta. This is considered as possibly the single most important ecosystem in the area and potentially the most vulnerable to disruption from either acute or chronic pollution problems. The deep water harbor of Port Clarence is also discussed as an area where further studies are needed to ensure proper planning and development of petroleum related activities in this area. (Sinha-OEIS)
W79-10034

INTERTIDAL BIOTA AND SUBTIDAL KELP COMMUNITIES OF THE KODIAK ISLAND AREA,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
S. T. Zimmerman, J. L. Hanson, J. T. Fujioka, N. I. Calvin, and J. A. Gharrett.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 316-508, March 1979. 114 fig, 29 tab, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assesment Program, Boulder, CO.

Descriptors: *Baseline studies, *Water pollution effects, *Intertidal areas, *Biota, Kelps, Alaska, Resources development, Oil pollution, Environmental effects, Ecosystems, *Outer Continental Shelf, Petroleum development.

The overall objective of this study was to generally describe the distribution of littoral habitats and their associated biota by a combination of qualitative and quantitative observations. Because of the immense area covered and limited time, research has necessarily been extensive rather than intensive. The results generally reflect a 'survey' approach rather than the more prediction-oriented baseline or monitoring approaches which are often used to study areas of potential impact. As these littoral areas are more clearly delineated, research will be oriented toward monitoring changes in specific areas. This report summarizes the results of work in the Kodiak Island area and makes the information available before leasing decisions concerning that area are made. It was attempted to determine the distribution and percent occurrence of each type of major intertidal habitat and the assemblages of plants and animals that occur in these habitats. (Sinha-OEIS)
W79-10035

SORTING AND IDENTIFICATION OF INTERTIDAL SAMPLES,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
J. Hanscom, D. Masiak, L. Shandelmeier, and G. Mueller.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 509-573, March 1979. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-7-208-35135.

Descriptors: *Baseline studies, *Intertidal areas, *Systematics, *Alaska, Resources development, Environmental effects, Water pollution effects, Oil pollution, *Outer Continental Shelf, Petroleum development.

The stations and taxonomic problems encountered are summarized. The report is divided into three parts: Introduction, Station List and Taxonomic Section. The taxonomic section is further divided in a discussion of significant taxonomic problems, a species list, and the major references used for determination of the group. The taxonomic order is of convenience and not strictly hierarchical. Within the past three years well over 2,000 samples from approximately 80 localities were analyzed. The species composition, numbers of individuals, and in many cases wet and dry weights were determined. (Sinha-OEIS)
W79-10036

BASELINE STUDIES OF THE DEMERSAL RESOURCES OF THE EASTERN AND WESTERN GULF OF ALASKA SHELF AND SLOPE: A HISTORICAL REVIEW,
National Marine Fisheries Service, Seattle, WA. Northwest Fisheries Center.
W. T. Pereyra, and L. L. Ronholt.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 574-669, March 1979. 1 fig, 29 tab, 11 ref, 2 append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fisheries, *Statistics, *Baseline studies, Resources development, Water pollution effects, Oil pollution, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

Included in this report is a description of the Survey Area, a 2,200 kilometer long arc in the Gulf of Alaska from Cape Spencer to Unimak Pass. The area contains 220,000 sq km of which 36% is in the 0-100 m depth zone, 48% in the 101-200 m depth zone, and 16% in the 201-400 m depth zone. The fish and invertebrate fauna are described. The fishes include 287 species belonging to 55 families. The invertebrate fauna is less well defined than fish fauna, but 13 commercially valuable species from 5 families are included. Comparisons between the results of resource abundance surveys in the Gulf of Alaska during 1961 and those in 1973-1976, indicate a statistically-significant increase in walleye pollock and Dover sole, and a decrease in Pacific ocean perch. Changes in catch per unit of effort (CPUE) from the 1960's to the 1970's were noted in each of 7 regions of the

Survey area, 3 depth zones, and 21 region-depth zones. Comparison between the 1960 and 1970 surveys was also made with reference to the distribution of biomass and rank order of prominent species in catch per sq km, both of which varied widely and suggested that dramatic changes have occurred over the years. (Sinha-OEIS)
W79-10037

BEAUFORT SEA ESTUARINE FISHERY STUDY,
Alaska Dept. of Fish and Game, Fairbanks. Div. of Sport Fish.
T. N. Bendock.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 670-729, March 1979. 20 fig, 7 tab, 33 ref, append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-69.

Descriptors: *Baseline studies, *Fisheries, *Statistics, Water pollution effects, Oil pollution, Environmental effects, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

Petroleum exploration and development is rapidly increasing throughout the near shore areas of the Beaufort Sea. The demands by industry for construction material, gravel sources, fresh water and transportation avenues are substantial. Alterations of the physical environment resulting from water and gravel removal or the construction of roads, pads and causeways are imminent. Information on the biology of fish inhabiting these waters is necessary prior to evaluating the ultimate effects these activities have on the resource. The objectives of this study are to determine the distribution and relative abundance of the various species of fish inhabiting the near shore environs of the Beaufort Sea. By correlating important life history data with the knowledge of habitat needs, it is hoped to obtain base line information that can be used to direct the activities of people and industry in the proposed lease area. (Sinha-OEIS)
W79-10038

PRELIMINARY OBSERVATIONS ON THE DISTRIBUTION ABUNDANCE AND FOOD HABITS OF SOME NEARSHORE FISHES IN THE NORTHEASTERN GULF OF ALASKA,
Alaska Coastal Research, Homer.
R. J. Rosenthal.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 730-804, March 1979. 6 fig, 21 tab, 19 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Fisheries, *Ecology, *Baseline studies, Statistics, Resources development, Water pollution effects, Oil pollution, Alaska, Estuarine fisheries, *Outer Continental shelf, Gulf of Alaska, Petroleum development.

The nearshore fishes and their respective habitats are most vulnerable to disturbances and perturbations associated with OCS development in the Gulf of Alaska. This report deals with the marine fishes of the northeastern Gulf of Alaska; more specifically, the teleostean fishes that typically inhabit the inshore zone from the intertidal/subtidal fringe out to depths of around -30 meters. Numerical data was collected on relative abundance and occurrence in the nearshore zone. In all, 1410 sq m of sea floor were examined quantitatively at Schooner Rock, Hinchinbrook Entrance and Danger Island, Montague Strait. Descriptions of major habitat types, and summer distributions of inshore pelagic and demersal species are presented in relation to substrate type, depth and vegetation. The emphasis was placed on the characteristic or conspicuous fishes that were believed to be either numerical or functional dominants in the nearshore system. (Sinha-OEIS)
W79-10039

LEVELS AND SOURCES OF CRITICAL TRACE METALS IN THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5B.
W79-10040

ACUTE TOXICITY OF HEAVY METALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. A. Craddock.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 52-81, March 1979. 4 tab, 40 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Toxicity, *Heavy metals, *Arctic, *Baseline studies, Resources development, Environmental studies, Water pollution, Water pollution sources, Cadmium, Nickel, Chromium, Lead, *Outer Continental Shelf, Petroleum development.

The toxic effects of heavy metals on marine species and more specifically of the effect on arctic and subarctic species were studied. The metals that were considered are four important metals associated with the production of petroleum: cadmium, chromium, nickel, and lead. Heavy metals in solution in seawater affect marine organisms mainly by adsorption. Adsorption may occur across the general body surfaces and through special structures such as gills, and in teleosts, which ingest seawater; absorption also takes place across the walls of the gut. Of the four metals under consideration, cadmium may remain in aerated seawater in the greatest concentrations, followed by nickel, lead and chromium. The concentration of a metal lethal to a marine organism depends on the metal and the organism. The toxicity of each of the four metals is treated briefly and a tabulation of reported toxicity by phyla for each is included. (Sinha-OEIS)
W79-10041

PATHOLOGY OF ARCTIC AND SUBARCTIC MARINE SPECIES AND EXPOSURE TO TRACE METALS ASSOCIATED WITH PETROLEUM,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. O. Hodgins, and J. W. Hawkes.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 82-92, March 1979. 37 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Pathology, *Metals, *Arctic, *Trace elements, Water pollution effects, Resources development, Baseline studies, Environmental effects, Cadmium, Chromium, Nickel, Lead, *Outer Continental Shelf, Petroleum development, Neoplasia, Immunosuppression, Cellular alterations.

There is little published information on pathological effects resulting from exposure of arctic and subarctic marine vertebrates and invertebrates to petroleum-associated trace metals (defined as primarily cadmium, chromium, nickel, and lead for this review). There is some published information, however, on pathological effects of these and other trace metals on other species, which by inference may be applicable to arctic animals. Examples of studies on trace metals implicated in neoplasia, immunosuppression, and in alterations in cellular and subcellular structure are presented. Whether similar effects actually do or can occur in arctic marine species mostly remains to be demonstrated. (Sinha-OEIS)
W79-10042

METABOLISM OF TRACE METALS: BIOACCUMULATION AND BIOTRANSFORMATION IN MARINE ORGANISMS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
U. Varanasi, and D. C. Malins.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 93-224, March 1979. 33 fig, 38 tab, 111 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Heavy metals, *Baseline studies, *Metabolism, *Water pollution effects, Environmental effects, Resources development, Alaska, Cadmium, Lead, Chromium, Nickel, *Outer Continental Shelf, *Bioaccumulation, *Biotransformation, Petroleum development.

Studies with plankton support the view that these organisms are capable o concentrating cadmium from the marine environment to produce tissue levels many-fold greater than expoure levels. The toxic effects of lead include anemia, due to reactions of lead with hemoglobin and erythrocytes and to the tendency of this metal to interfere with porphyrin biosynthesis. Chromium has been detected in living organisms in only trace amounts and apparently has no known essential function in the physiology of either plants or animals. Chromium is toxic, especially to aquatic animals. Chromium exists in the +2, +3, +5, and +6 valence states, the trivalent and hexavalent species being more stable. Apparently, hexavalent chromium is assimilated more readily in organisms than trivalent chromium and is found to be at least a hundred times as toxic as the trivalent form. A few studies showed detectable levels of nickel in various marine animals obtained from relatively polluted areas indicating that nickel, in common with other trace metals, is accumulated to a much higher level than that existing in surrounding seawater. (Sinha-OEIS)
W79-10043

BEHAVIORAL AND PHYSIOLOGICAL EFFECTS INDUCED BY SUBLETHAL LEVELS OF HEAVY METALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
W. L. Reichert.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 225-240, March 1979. 1 fig, 5 tab, 20 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Heavy metals, *Water pollution effects, *Physiology, Resources development, Environmental effects, Alaska, Cadmium, Chromium, Lead, Nickel, *Outer Continental Shelf, *Sublethal effects, Petroleum development.

The physiological and behavioral effects of cadmium, chromium, lead and nickel on marine organisms under saline conditions are reviewed. The effects of metals on physiological responses of marine organisms are dependent on the temperature and salinity of the marine environment. In general, physiological effects of heavy metals increase with increasing temperature and decreasing salinity. The sparse literature on the physiological and behavioral effects of lead, cadmium, nickel and chromium presently provides insufficient background for balanced judgments relating to acceptable levels of these metals in the marine environment. (Sinha-OEIS)
W79-10044

GENERAL EFFECTS OF METALS ON THE ECOSYSTEM,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. R. Sanborn.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 241-244, March 1979. 4 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program. Boulder, CO.

Descriptors: *Salt marshes, *Heavy metals, *Water pollution effects, Ecosystems, Resources development, Baseline studies, Environmental effects, *Outer Continental Shelf, Petroleum development.

Studies of the salt marsh have produced information on the cycling and budgets of metals in this ecosystem. Salt marsh sediments are reduced and act as sinks for metals. The metals are picked up by the roots of the marsh vegetation and incorporated in the above-ground tissue. Half of the annual standing crop of the marsh grass is transported to deeper water by tidal flushing and thus the incorporated metals are exported to deeper water. The literature reveals only a very limited view of the effects of chromium, nickel, lead, and cadmium on the ecosystem. The available information deals only with cycling and budgets with no information on the effects of the metals on the ecology of the animals and resultant effects on populations and communities. (Sinha-OEIS)
W79-10045

MIGRATION OF BIRDS IN ALASKA MARINE HABITATS,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
R. Gill, Jr., C. Handel, and M. Petersen.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 245-288, March 1979. 14 fig, 2 tab, 72 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 01-06-022-11437.

Descriptors: *Birds, *Migration, *Alaska, *Water pollution effects, *Oil pollution, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, Petroleum development.

Existing data on the timing, routes, patterns and magnitudes of bird migrations in Alaskan OCS areas is summarized and these events are related to lease area activities. From the available data, timing and routes have been generalized for those species (alcids and seaducks) which have demonstrated a high susceptibility to oil contamination. In addition, migration for species (shorebirds) which have, to date, shown little susceptibility to oil contamination but which depend on habitats most likely to be adversely affected by nearshore oil related impacts is discussed. Alteration of avian food resources in littoral areas, especially those used for staging and/or molting by waterfowl as well as shorebirds, could affect entire populations with, as yet, unknown consequences to the species' population as a whole. As now understood, migration of most species occurs over and/or along inshore waters throughout coastal Alaska. (Sinha-OEIS)
W79-10046

AVIAN COMMUNITY ECOLOGY AT TWO SITES ON ESPENBERG PENINSULA IN KOTZEBUE SOUND, ALASKA,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
D. Schamel, D. Tracy, P. G. Mickelson, and A. Seguin.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 289-607, March 1979. 109 fig, 68 tab, 89 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-56.

Descriptors: *Birds, *Ecology, *Oil pollution, *Water pollution effects, Alaska, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, Petroleum development, Sand mining.

Cape Espenberg, a 1.5 km wide peninsula, jutting into the western edge of Kotzebue Sound in western Alaska, is comprised of a series of sand dune ridges, interspersed with numerous ponds and marshes. Prevailing winds are westerly during the summer and currents, which sweep nearshore at Espenberg, come from the west. Thus, large oil spills on Chukchi Sea waters north of the Bering Strait to Kotzebue Sound are likely to be deposited on the beaches of Cape Espenberg. Oil contamination of nearshore waters poses a threat to bird populations throughout the summer. Oil in leads in the ice may affect spring migrants which often concentrate there. Numerous birds rely upon marine food sources throughout the summer and would be subjected to oil contamination while foraging at sea or along the coast. Birds may also be indirectly affected by oil contamination through loss of food resources. The beach of Cape Espenberg is a likely site of sand extraction for petroleum development and related activities. Such activity during summer may produce sufficient turbidity to lower the feeding efficiency of birds near the site and downcurrent. Associated noise may lower the productivity of some nesting birds. Of prime concern, however, is the possibility that sand extraction may endanger the integrity of the Cape through erosion of the dunes. This might jeopardize the marsh habitat and its extremely high concentration of nesting waterbirds. (Sinha-OEIS)
W79-10047

AVIAN COMMUNITY ECOLOGY OF THE AKULIK-INGLUTALIK RIVER DELTA, NORTON BAY, ALASKA,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
G. F. Shields, and L. J. Peyton.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 608-710, March 1979. 14 fig, 20 tab, 14 ref, 2 append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-56.

Descriptors: *Birds, *Ecology, *Oil pollution, Water pollution effects, Alaska, Environmental effects, Baseline studies, Resources development, *Outer Continental Shelf, Norton Sound, Petroleum development.

The Norton Sound area of western coastal Alaska has high potential for future petroleum related exploration and development activities. Avian species diversity in the area is relatively high but the majority of species are either spring or fall migrants most of which frequent the area in small numbers. Breeding species diversity is relatively low but nesting densities of some species in optimum habitats are moderate to high. The delta is used extensively by a number of waterfowl species and cranes in the spring and by a variety of waterfowl, shorebirds, and particularly cranes in the fall. Limited use of the delta is recommended particularly during spring and summer when potential nesters are affected greatly by human related activity. The importance of exposed near-shore mudflat and delta pond edges as feeding and staging areas primarily during spring and fall migrations are indicated. Finally caution is recommended regarding the use of all-terrain-vehicles especially in the spring when peak periods of native hunting on the delta may coincide with melt-off and the exposure of virgin tundra area. (Sinha-OEIS)
W79-10048

PROCEEDINGS OF A WORKSHOP ON SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, ESTES PARK, COLORADO, JULY 10-14, 1978,
For primary bibliographic entry see Field 5A.
W79-10049

SYNTHETIC ORGANICS,
Environmental Research Lab., Gulf Breeze, FL.
P. A. Butler, R. Huggett, K. Macek, R. Reinert, and R. Risebrough.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 13-22, March 1979. 2 fig, 10 ref.

Descriptors: *Water pollution effects, *Organic compounds, Chemical wastes, Waste disposal, Chlorine, Synthetic organics, Ocean pollution.

Synthetic, organic chemicals present a 'text-book' example of the complexities involved between the antagonists - the pollutants, and the protagonists - the organisms they affect. The proposed research activities center about strategies to manage and manipulate the existing and forthcoming data that relate to both pollutant concentrations and their biological effects. The synthetic organic chemicals of concern contain chlorine atoms and are analyzed by gas chromatographic techniques. The development of a national, computerized network for accumulation and storage of information about spectral peaks on gas chromatograms is the primary research activity proposed relative to pollution from synthetic organics. (See also W79-10049) (Sinha-OEIS)
W79-10050

CHLORINATION PRODUCTS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. H. Carpenter, R. M. Bean, W. J. Blogoslawski, W. Davis, and R. L. Jolley.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 23-34, March 1979. 1 fig, 40 ref.

Descriptors: *Water pollution effects, *Chlorination, Industrial wastes, Bromine, Resources development, Outer Continental Shelf, Organic halocarbons, Ocean pollution.

The transfer of heat and some wastes to the marine system is producing another category of pollutants--the chlorination products. Chlorine is introduced to waste waters to disinfect them partially and to industrial waters to minimize slime and other types of biofouling. The chlorine interacts with the organic materials of seawater to produce chlorinated substances and with the bromate ion to produce bromine and hence brominated organic compounds. Among the compounds formed are chloroform and bromoform, both of which have carcinogenic and mutagenic properties. Scattered but increasing evidence indicates that undesirable impacts on marine organisms are associated with the use of these chlorination products. It is recommended that priority attention be given to problems concerning the composition and formation of the higher molecular weight organic halocarbons. (See also W79-10049) (Sinha-OEIS)
W79-10051

LITTER,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W79-10053

ARTIFICIAL RADIONUCLIDES,
Battelle Pacific Northwest Labs., Richland, WA.
W. L. Templeton, F. Harrison, I. Ophel, J. Simpson, and N. Cutshall.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 69-103, March 1979. 9 tab, 42 ref.

Descriptors: *Radioisotopes, *Water pollution effects, *Water pollution sources, Monitoring, Environmental effects, Outer Continental Shelf, Biological effects, Ocean pollution, Ocean dumping.

Monitoring surveillance and research have provided the data that have enabled us to predict the distribution of radionuclides and their reactions in oceans, and to keep human exposure within the guidelines specified by international and federal bodies. Predictions have been validated by follow-up surveys. In terms of ecological effects, the consensus of the literature is that radionuclides are not likely to be significantly deleterious in populations of marine organisms at the dose rates estimated for the most contaminated environments. Although predictions are subject to revision in the light of new knowledge, there is no evidence that the past and present practices, or present policies for radioactive waste disposal in the oceans, have jeopardized humans or any marine species. Present knowledge on artificial radionuclides in the oceans have identified research needs in the following program areas: deep-ocean data base for subseabed emplacement of high-level radioactive wastes, long-term monitoring, chemistry of radioelements, marine sedimentation and remobilization. biological effects of chronic low-level exposures.

and monitoring of existing dump sites. (See also W79-10049) (Sinha-OEIS)
W79-10054

MICROORGANISMS,
Rhode Island Univ., Kingston.
V. J. Cabelli, A. F. Carlucci, C. D. Litchfield, T. G. Metcalf, and R. A. Murchelano.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 104-129, March 1979. 1 fig, 91 ref.

Descriptors: *Microorganisms, *Water pollution sources, *Monitoring, Water pollution effects, Ecosystems, Environmental effects, Resources development, Outer Continental Shelf, Ocean pollution.

Microorganisms released into coastal waters by discharges of human and lower animal wastes can jeopardize public health, since some of these organisms are agents of both human and faunal disease. Association, if not causality, between a form of pollution and some detrimental effect is strong enough in some instances to support criteria, guidelines, and standards as well as monitoring programs. There is a critical need for additional epidemiological or epizoological data, information associating pollution levels with human and faunal disease and the densities of the etiological agents involved, and research on methodology (especially as related to faunal disease). There is also a critical need for data concerning the roles of microorganisms in marine ecosystems and documenting any effects of pollutants on their activities. Recommendations for research and monitoring related to effects of microorganisms are listed. (See also W79-10049) (Sinha-OEIS)
W79-10055

TRACE METALS,
Southern California Coastal Water Research Project, El Segundo.
D. Young, C. K. Bertine, D. Brown, E. Crecelius, and J. Martin.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 130-152, March 1979. 3 fig, 65 ref.

Descriptors: *Metals, *Heavy metals, *Toxicity, *Water pollution effects, Ecosystems, Resources development, Environmental effects, Outer Continental Shelf, Ocean pollution.

During the past 5 years marine chemists have found that the concentrations of some trace metals in sea water are one or several orders of magnitude less than had previously been believed. The ability to sample sea water and to analyze it accurately for its trace metal without introducing contaminants has led to this discovery. As a consequence, human mobilization of metals such as lead, cadmium, copper, zinc, and chromium may be as great or even greater than movement of the metals in the major weathering cycles. Several areas of concern have developed: the impact on human health of the ingestion of seafoods enriched in trace metals, the toxicity of trace metals to marine organisms, and the disruption of ecosystems through trace-metal caused alterations of phytoplankton populations. (See also W79-10049) (Sinha-OEIS)
W79-10056

BIOSTIMULANTS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
H. Curl, Jr., R. Dugdale, E. Jenne, D. P. Larsen, and R. Lasker.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 153-177, March 1979. 2 fig, 2 tab, 19 ref.

Descriptors: *Ecosystems, *Anaerobic conditions, *Aquatic plants, Water pollution effects, Resources development, Fishkills, *Biostimulants, Outer Continental Shelf, Ocean pollution, Anoxic conditions.

A continually increasing input to coastal waters of substances that enhance the growth of marine plants has altered marine ecosystems, usually in an undesirable way. These biostimulants, which include compounds of nitrogen, phosphorus, silicon, and metals, as well as dissolved organics, are introduced primarily in sewer outfalls. Perhaps their most dramatic effects are alterations in the composition of the food chain base and increases in plant population. Small microscopic plants, the diatoms which support large fish populations, are displaced by flagellates (marine weeds), poor foods for many of these grazers. The increased plant life can result in excessive oxygen consumption in the waters, leading to anoxic conditions, a situation that has been reported to result in fish kills, often of commercially important species. Anoxic conditions also discolor and cause unpleasant odors in waters and render them unpleasant for aesthetic and recreational uses. The primary research problem is to distinguish between natural and anthropogenic biostimulus to coastal ecosystems and to assess the magnitude of each. (See also W79-10049) (Sinha-OEIS)
W79-10057

FOSSIL FUEL COMPOUNDS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
J. G. Quinn, J. N. Butler, J. W. Farrington, D. C. Gordon, Jr., and J. L. Laseter.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 178-203, March 1979. 1 fig, 2 tab, 78 ref.

Descriptors: *Fossil fuels, *Water pollution effects, Resources development, Environmental effects, *Outer Continental Shelf, Biogeochemistry, Petroleum.

Petroleum compounds and their degradation products are the main components of this group of pollutants. Petroleum usage is predicted to decrease substantially in the next 30 years or so; simultaneously, use of coal and oil shale will increase as energy sources and feedstocks for the production of chemicals. Coal gasification and liquefaction, shale processing, and combustion and transport introduce many of the same compounds into the environment that petroleum does. Preventing significant adverse impact on humans and the environment will require substantial knowledge of the biogeochemistry and effects of fossil fuel compounds and their reaction products. The main problems that must be investigated to obtain that knowledge are described. (See also W79-10049) (Sinha-OEIS)
W79-10058

BIOLOGICAL EFFECTS - A GENERIC VIEW,
Woods Hole Oceanographic Institution, MA.
J. Teal, B. McCain, P. Jumars, J. Stegeman, and R. Howarth.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 204-219, March 1979. 17 ref.

Descriptors: *Water pollution effects, *Ecosystems, *Monitoring, Resources development, Environmental effects, Ecology, *Outer Continental Shelf, Biological effects, Ocean pollution.

With careful management the oceans can continue to supply us with fish, shellfish, other food or natural products, petroleum, and minerals. But pollution and inadequate care in preventing potential conflicts among competing resource uses can jeopardize our renewable marine resources and disrupt human societies. It is proposed that long-term studies of the natural variation in unpolluted marine ecosystems be initiated so it can be determined what types of changes are normal. Complementing these ecological studies would be investigations involving the manipulation of small ecosystems by introducing pollutants, followed by studies of their effect. Finally the proposed research programs must be accompanied with surveillance programs to monitor pollutant levels at given sites during exteneded time periods. (See also W79-10049) (Sinha-OEIS)
W79-10059

5D. Waste Treatment Processes

DISINFECTION OF WATER: PROS AND CONS,
National Inst. for Water Research, Pretoria (South Africa).
W. O. K. Grabow.
Water S.A., Vol. 5, No. 2, p 98-105, 1979. 83 ref.

Descriptors: *Water purification, *Chlorination, *Disinfection, Microorganisms, E. coli, Sewage bacteria, Pathogenic bacteria, Viruses, Water quality control, Potable water, Chlorine, Ozone, Ultraviolet radiation, Bromine.

It is estimated that 500 million people each year are affected by incapacitating water-borne or water-associated diseases, and as many as 10 million die. A wide range of pathogenic micro-organisms are associated with the transmission of disease by water. Chlorine is the most widely used disinfectant today. It is used for disinfection of drinking water, decontamination of waste water effluents, the inhibition of fouling in electric powerplants, disinfection of equipment, treatment of swimming pools, and many other purposes. Advantages of chlorine are: (1) when properly used it can ensure complete inactivity of all micro-organisms, (2) it is the cheapest means of disinfection, and (3) it has a residual effect as chloramines also inactivate micro-organisms. However, the chlorination of partially purified water has serious implications. Many pathogenic micro-organisms, particularly viruses, often survive treatment. Also, chlorinated compounds that may be toxic, mutagenic, or carcinogenic are created. These disadvantages can be overcome by selected application of waste water chlorination, dechlorination of treated effluents, or by alternative methods of disinfection such as ozonation, chlorine dioxide, bromine and iodine, bromine chloride, ultraviolet radiation, ionizing radiation, silver, photodynamic oxidationn, and advanced tertiary treatment and waste water reclamation. (Seigler-IPA)
W79-09845

WASTEWATER TREATMENT WITH DESORBING OF AN ADSORBATE FROM AN ADSORBENT WITH A SOLVENT IN THE NEAR CRITICAL STATE,
Little (Arthur D.), Inc., Cambridge, MA. (Assignee).
M. Modell.
U.S. Patent No. 4,147,624, 14 p, 6 fig, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 981, No. I, p 237-238, April 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Industrial wastes, Organic wastes, Absorption, Condensation, *Regeneration, Polymeric adsorbents.

The object of this invention is to provide an improved process for wastewater purification using in particular polymeric adsorbents to remove organic impurities and an inert solvent in the form of a near critical liquid to extract absorbates from the adsorbent to regenerate it. The process comprises the steps of contacting the adsorbent with a near critical liquid which is a solvent for the adsorbate. The near critical liquid containing the dissolved adsorbate is then subjected to at least partial vaporization to form a vapor in which the adsorbate is substantially less soluble thereby making it possible to remove the adsorbate from the near critical liquid. The vapor is then condensed to restore it to the near critical liquid state wherein it is a solvent for the adsorbate so that it may be reused. The process is particularly well suited to the removal or organic materials such as color bodies, surfactants and biological materials from wastewaters. (Sinha-OEIS)
W79-09929

PROCESS AND APPARATUS FOR SEPARATING MATTER IN SUSPENSION IN A LIQUID,

Societe Anonyme d'Etudes de Recherches et de Productions d'Agents Chimiques, Paris (France). (Assignee).
G. M. Treyssac.
U.S. Patent No. 4,146,472, 5 p, 1 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1413, March 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Separation techniques, Flow, Flow regulation, Suspended solids, Bubbles, Equipment.

A process and a device for separating matter in suspension in a liquid, such as floccules in suspension in water, consists of treating this liquid with particles, particularly gaseous particles, which moving under the effect of gravity carry along the matter in suspension. The separation process is characterized in that it consists in causing the liquid to be treated and a fluid of the same density charged with the particles to circulate in two superimposed, distinct and parallel flows, so that the particles contained in the fluid pass through the liquid to be treated under the action of gravity. The flotation apparatus for implementing the process comprises a treatment chamber provided, at one of its ends, with an inlet for the liquid to be treated circulating without turbuluence and, at the other end, an outlet for the treated liquid. An inlet pipe for the treatment water under high compression charged with gas is placed at the lower part of the treatment chamber and is located below and in the neighborhood of the inlet for the liquid to be treated. An outlet pipe for the treatment water is placed at the lower part of the chamber, below and in the neighborhood of the outlet for the treated liquid. (Sinha-OEIS)
W79-09941

CLOSED SPIRAL PATH WASTE WATER TREATMENT SYSTEM,
Activox, Inc., New York. (Assignee).
P. I. Rongved.
U.S. Patent No. 4,146,478, 9 p, 7 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1415, March 27, 1979.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Aeration, Activated sludge, Circulation, Aerobic conditions, Equipment.

A continuous waste water treatment system comprises a reservoir providing a single, closed, continuous, substantially horizontal path through at least two adjacent substantially concentric loops. Each of the loops have a beginning and an end. The reservoir is provided with waste water inlet means, treated liquid outlet means, and aeration and circulation means. The treated liquid outlet is connected to clarifying means which removes at least some of the sludge carried by the treated liquid and the sludge return is provided to return at least some of the removed sludge to the reservoir. (Sinha-OEIS)
W79-09947

WATER FACTORY 21 DESIGN AND OPERATING DATA,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 602, Price codes: A07 in paper copy, A01 in microfiche. Final Report prepared for the Office of Water Research and Technology, July 1979. 131 p, 6 fig, 21 tab, 4 append. OWRT (7533) (1), 14-34-0001-7533.

Descriptors: *Advanced wastewater treatment, *Facilities, Biological treatment, *Water reuse, Orange County Water District(CA), Demineralization, Reverse osmosis, Design data, Costs.

Water Factory 21 is a 15-mgd advanced wastewater treatment plant designed to improve the quality of biologically treated municipal wastewater so that it can be injected into a seawater barrier system. Treatment processes include lime clarification, ammonia stripping, breakpoint chlorination, filtration, activated carbon adsorption, reverse osmosis demineralization, and final chlorination. Because of increased interest in the utilization of advanced wastewater processes such as demineralization, this study was initiated to evaluate the performance of a large scale reverse osmosis system. The 5-mgd reverse osmosis system was designed to remove 90% of the dissolved minerals from the treated wastewater while achieving an overall product water recovery of 85%. In addition, reverse osmosis has proved very effective in removing dissolved organics from reclaimed wastewater. The data collected show that the combined processes, including demineralization, provide for an overall COD reduction of greater than 95%, producing an effluent with a mean COD of less than 2.0 mg/l. Operation of the large scale reverse osmosis system has demonstrated its feasibility. Its on-line performance during the first year of operation has been greater than 90% while achieving 90% rejection of all salts. The cost of large scale reverse osmosis demineralization is $0.62/1000 gal., including a capital cost of $0.17/1000 gal and an operating cost of approximately $0.49/1000 gal.
W79-09961

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY: SUMMARY REPORT,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 792, Price codes: A03 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, March 1976. 32 p, 2 tab, 6 fig.

Descriptors: *Waste water treatment, *Comprehensive planning, *Massachusetts, *Treatment facilities, *Water quality, *Waste water management, *Sludge management, Waste treatment, Waste water(Pollution), Waste water disposal, Regional analysis, Sewage districts, Pumping plants, Interceptor sewers, Sludge treatment, Organizations, Facilities, Financing, Boston(MA).

An inter-agency study group, organized in 1973, addressed methods for combatting pollution in the Boston Harbor-Eastern Massachusetts Metropolitan Area (EMMA) and vitally affecting the Metropolitan Sewer District (MSD). Its efforts are summarized in this volume. An introduction outlines the study's purpose and management. The existing situation in organization, facilities and finance is reviewed. Conclusions concerning population growth, sewer service, pollution abatement, system capacity and saltwater intrusion, satellite plant possibilities and service costing are drawn. Recommendations for the upgrading of plant capability and service for both the Deer Island and the Nut Island Treatment Plants are presented, followed by recommendations for two more plants in outlying areas. Pumping station and interceptor improvements and new construction are suggested. Costs are reviewed and financing methods recommended. The plan is broken into three phases and each phase reviewed with suggestions for completion. Finally the status and relationship of other related programs is assessed. These programs include sludge management, facilities planning and ongoing areawide waste treatment planning efforts. (See also W79-09993 thru W79-10011) (Zayac-NC)
W79-09992

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 1: PLANNING CRITERIA,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09993

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 2: ENGINEERING CRITERIA,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 8B.
W79-09994

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 4: WATER ORIENTED WASTEWATER DISPOSAL CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 798, Price codes: A04 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 53 p, 8 fig, 13 tab.

Descriptors: *Waste water treatment, *Waste water disposal, *Massachusetts, *Sludge treatment, *Regional analysis, *Treatment facilities, Waste treatment, Water reuse, River basins, Economics, Cost analysis, Waste water management, Boston(MA), Regional-municipal systems, Decentralization.

This is a part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume investigates the water oriented wastewater utilization components of the EMMA Study's four proposed engineering concepts dealing with the planning area's anticipated wastewater management problems. Each concept is studied. The first looks at upgrading the systems within the present service area of the Deer and Nut Island wastewater treatment plants, with no expansion. The second concept proposes contraction of the service area tributary to the two treatment plants by creating five additional regional treatment systems. The third studies maximum expansion of the service areas, and the fourth looks at decentralization of wastewater treatment by construction of six more regional systems within the present service area of the Metropolitan District System. Considerations of the concepts include that they must be financially and technically feasible, existing facilities be incorporated into any regional systems, regionalization be sufficiently flexible to accomodate immediate needs economically, and receiving waters be considered in terms of both quality and flow requirements. A detailed discussion is presented of the four plans, with an overview of the plan noting advantages and disadvantages, followed by a discussion of those facilities that are located within the service area of the two plants, and the regional and municipal wastewater treatment systems that are located outside of this service area. An analysis of the feasibility of regionalization of sludge management using the fourth concept as a basis is presented. (See also W79-09992) (Zayac-NC)
W79-09997

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 5: LAND ORIENTED WASTEWATER UTILIZATION CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09998

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 8B.
W79-10001

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLI-

TAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 10: DEER ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 804, Price codes: A05 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 62 p, 10 fig, 10 tab, 3 append.

Descriptors: *Massachusetts, *Cost analysis, *Waste water treatment, *Design criteria, *Treatment facilities, *Waste water management, *Waste water(Pollution), *Treatment plant design, Cost allocation, Operating costs, Maintenance costs, Aeration, Filtration, Sedimentation, Chlorination, Sewage treatment, Boston(MA), Primary facilities, Secondary facilities, Upgrading, Plant outfall, Pumping stations.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This volume covers the basic design for upgrading the Deer Island plant and for providing those facilities that would be required to accomplish secondary treatment, including flows and costs. The existing facilities are described--plant operations, adequacy of existing facilities, the main pumping station, the preaeration facilities and the plant outfall system. More detail is then provided concerning the primary treatment facilities in order to discuss the need to provide additional primary treatment facilities to meet the 2000 year needs at the Deer Island Plant. Basic design criteria are reviewed, and information is provided on preaeration channels, primary sedimentation tanks, outfall systems, chlorination facilities and the effluent pumping station. Secondary treatment facilities are described. Alternative layouts are presented, including seven site options. Finally, suggestions for phased development of the recommended Deer Island Treatment Plant are made, with comparative costs presented for each phase, annual operating and maintenance costs and cost distribution. Appendices include a listing of principal equipment, a description of the main treatment plant, and an inventory. (See also W79-09992) (Zayac-NC)
W79-10002

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 11: NUT ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 805, Price codes: A04 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 51 p, 8 fig, 8 tab, 3 append.

Descriptors: *Massachusetts, *Waste water treatment, *Waste water(Pollution), *Treatment facilities, *Waste water management, Aeration, Filtration, Sewage treatment, Cost analysis, Construction costs, Operating costs, Maintenance costs, Pumping, Outfall sewers, Sedimentation, Sludge treatment, Boston(MA), Primary treatment, Secondary treatment.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this volume is to study and analyze the necessary improvements to the primary treatment facilities at the Nut Island Wastewater Treatment Plant, together with the work necessary to provide secondary treatment facilities. The existing plant and operations are described. The adequacy of individual facilities are checked. These include preliminary treatment, influent pumps, preaeration, primary sedimentation, sludge pumping, scum collection and chlorination facilities, the heating and electrical plants, and the outfall system. Sizing and basic design of the proposed secondary facilities are reviewed. Alternative arrangements are discussed, and the selected plan is described. It includes an additional 24.8 acres of fill on Nut Island for secondary treatment. The total estimated cost for facilities for secondary treatment is $137,236,000, excluding sludge management facilities. A plan for phased development is recommended and construction costs are presented for the proposed first and second phases, and for operation and maintenance costs. A cost distribution scheme is suggested. Appendices include a listing of principal equipment, a description of the main treatment plant, and an inventory. (See also W79-09992) (Zayac-NC)
W79-10003

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 15: RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 814, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 144 p, 20 fig, 36 tab.

Descriptors: *Massachusetts, *Engineering structures, *Planning, *Water quality, *Waste water treatment, *Comprehensive planning, *Waste water management, *Implementation, *Facilities planning, Management, Sanitary engineering, Financing, Cost analysis, Cost allocation, Cost repayment, Construction costs, Operating costs, Maintenance costs, Sites, Design criteria, Sludge disposal, Sludge treatment, Treatment facilities, Boston(MA), Interceptors, Headworks, Pump stations, Primary treatment, Secondary treatment.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This volume covers the recommended course of action for the study area--a decentralized system based on combined sewer regulation facilities. Combined sewer overflow regulation is studied through a review of policy, program recommendations, consideration of water quality needs and the recommended course of action. The satellite wastewater treatment plants are reviewed by looking at basic design criteria, site layouts, costs and sludge management techniques. Interceptor, pumping stations and headworks improvements to the existing system--including both the North and South Metropolitan Sewerage Systems--are analyzed by a discussion of interceptor relief requirements and headworks analysis and improvements. For both the Nut Island and Deer Island Treatment Plants, an inventory is provided of existing facilities, primary expansion, secondary extension, site requirements and phased development and costs. Construction staging and cost distribution is scrutinized more closely through a study of cost bases, annual operation and maintenance costs, and cost apportionment and allocation. Lastly, project financing and management is reviewed. (See also W79-09992) (Zayac-NC)
W79-10011

WASTEWATER MANAGEMENT PLAN. COLORADO RIVER AND TRIBUTARIES, TEXAS. SUMMARY,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 5G.
W79-10020

LOW COST METHODS OF TREATMENT OF AGRICULTURAL EFFLUENTS IN WARM CLIMATES,
Melbourne Water Science Labs. (Australia).
C. D. Parker.
Progress in Water Technology, Vol. 11, No. 1, p 267-278, 1978. 6 fig, 9 tab, 5 ref.

Descriptors: *Waste water treatment, *Water pollution treatment, Filtration, Effluents, *Public health, Water purification, Anaerobic conditions, Aerobic treatment, Oxidation lagoons, Trickle filters, Irrigation techniques, Water pollution control, Organic wastes, Environmental effects.

Described and illustrated in this paper are the applications of the low cost, low energy demanding processes of anaerobic and aerobic lagoons, oxidation ditches, trickling filters, anaerobic fermentations and irrigation (including flood irrigation, grass filtration, and spray irrigation) which can be applied in warm climatic areas to effectively control pollution from the organic type wastes of processing agricultural products such as fruit, milk, meat, vegetables, sugar, and wood products. Case histories are presented to illustrate the requisite conditions for the successful application of such processes under a variety of conditions and with consideration as to the public health aspects of each process. (Tickes-Arizona)
W79-10068

TREATMENT OF MERCURY CONTAMINATED AQUEOUS MEDIA,
Domtar Inc., Montreal (Quebec). (Assignee).
D. M. Findlay, and R. A. N. McLean.
U.S. Patent No. 4,147,626, 4 p, 4 tab, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 238, April 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Mercury, Chemical precipitation, Hydrogen ion concentration, Chlor-alkali plants.

A technique removes substantially all the elemental mercury from a mercury containing aqueous media by adjusting the pH of the liquid to the range of 7-13, adding a polysulfide in an amount sufficient to combine with the elemental mercury to form a mercury sulfide which is precipitated and prevents the mercury from being resolubilized. The major source of mercury contaminated aqueous media from chlor-alkali plants is the effluent from the cell sewers which collected all of the water from floor washings, spills, purge streams, wash waters, and drainage from tank cleaning. (Sinha-OEIS)
W79-10069

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER TREATMENT PLANTS: 1973-1977.
Dames and Moore, Denver, CO. Water Pollution Control Engineering Services.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 436, Price codes: A10 in paper copy, A01 in microfiche. EPA 430/9-77-013, January 1978. 211 p, 68 fig, 19 tab, 5 ref, 4 maps, 3 append.

Descriptors: *Waste water treatment, *Construction costs, *Bids, *Contract administration, *Estimating, *Analytical techniques, *Treatment facilities, Municipal wastes, Economics, Federal Water Pollution Control Act Amendments of 1972(PL 92-500), Contracts, Units costs, Forecasting, Public utilities, Regression analysis.

Construction bid data from 536 municipally owned wastewater treatment plants in all 10 regional offices of the U.S. Environmental Protection Agency were collected, categorized, and analyzed to provide reference for estimating future facility costs. All facilities sampled were funded after 1973 under PL 92-500, the Federal Water Pollution Control Act Amendments of 1972. The sample included 270 secondary plants and 267 advanced wastewater treatment (AWT) plants. Of the total, 225 are newly constructed plants, 38 are enlargements, 42 are upgrades, and 192 are both enlarged and upgraded facilities. Construction cost data are categorized according to three levels of detail: (1) first order--total plant construction costs; (2) second order--unit process construction costs and plan construction component costs; (3) third order--construction component costs of unit processes. Cost curves based on linear regression analysis are given which relate plant design flow for each order of data. Methods of estimating wastewater treatment plant costs based on first and second order cost curves are presented. All data used in the report are updated from the bid date to second quarter 1977 dollars using the EPA Wastewater Treatment Plant Cost indices. (Harris-Wisconsin)
W79-10080

5E. Ultimate Disposal Of Wastes

INFILTRATION OF LIQUID DAIRY MANURE INTO SOIL,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 520-528 and 531, May-June 1979. 10 fig, 6 tab, 12 ref.

Descriptors: *Infiltration, *Waste disposal, *Farm wastes, Soils, Soil water, Soil sealants, Suspended solids, Permeability, Temperature, Basins, On-site investigations, Dairy industry, Soil science, Agriculture, Liquid dairy manure.

Basin infiltrometers and double-ring infiltrometers were used on the subsoil of four different soils to determine the infiltration rate of various concentrations of liquid dairy manure. Raw manure was diluted with water by ratios varying from 3:1 to 50:1. The liquid used for most of the tests did not contain the heavy fibers that tend to settle out immediately after mixing. Total solids, S sub t, were the primary measure of concentration, and steady-state infiltration with water, I sub w, was the indicator used for the type of soil. It was that the infiltration rate was proportional to I sub w to the (0.11) power/S sub t to the (0.67) power at one week. All tests were conducted in the field, and thus the results were subject to temperature effects. It was found that the infiltration rate decreased sharply with a rise in temperature, a result which is contrary to the normal behavior of water in soil. (Sims-ISWS)
W79-09965

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 4: WATER ORIENTED WASTEWATER DISPOSAL CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09997

PUMP-TYPE SLUDGE DREDGING APPARATUS,
Toa Harbor Works Co., Ltd., Tokyo (Japan). (Assignee).
M. Norisugi.
U.S. Patent No. 4,145,982, 11 p, 7 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 24, April 3, 1979.

Descriptors: *Patents, *Dredging, Channel improvement, Sludge, Water quality control, Turbidity, Equipment.

An improved pump-type sludge dredging apparatus includes a pump dredger having a first ladder, a sludge suction pump acting in cooperation with the ladder and pump dredger, a suction pipe, a second ladder, a suction device suspended from the second ladder and connected to the pump through a suction pipe, a rotator, a half-cylindrical sludge collector plate, a substantially inverted U-shaped body structure, a grating, movable vanes disposed outside the grating and gas collecting chambers. The object of this invention is to provide a dredging apparatus which is capable of performing the dredging operation without disturbing sludge, to minimize turbidity of water and to recover the gas producer from the sludge during the dredging operations. (Sinha-OEIS)
W79-10017

5F. Water Treatment and Quality Alteration

STUDIES ON NATURAL WATER COAGULANTS IN THE SUDAN, WITH SPECIAL REFERENCE TO MORINGA OLEIFERA SEEDS,
Sudan Medical Research Council, Khartoum.
S. A. A. Jahn, and H. Dirar.
Water S.A., Vol. 5, No. 2, p 90-97, April 1979. 4 fig, 2 tab, 20 ref.

Descriptors: *Coagulation, *Water purification, *Turbidity, *Seeds, Water quality, Water pollution treatment, Flocculation, Root systems, Optical properties, Colorimetry, Bacteria, Potable water.

The coagulating properties of powdered seeds of Moringa oleifera Lam., powdered root of Maerua pseudopetalosa (alum), and a mixture of Hibiscus sabdariffa L. seeds and soda were compared. Moringa seeds have long been used as a traditional water coagulant in rural areas of the Sudan where many people have to use muddy water from rivers or intermittent streams during the rainy seasons or turbid water from natural rain ponds and from artifical rain water catchments (hafirs) most of the year. Raw water for the experiments was obtained from two hafirs. The coagulating effects of the plant materials and alum were studied by a simplified 'jar test'. The coagulant was added in a concentration of 200 mg/l to cylinders containing 500 ml of muddy water. Stirring was carried out for exactly 5 min. using a glass rod. The degree of clarification was measured in terms of optical density with a colorimeter. When compared, the reaction rates and turbidity reduction for alum and Moringa seeds were very similar. Alum gave only a 1% greater reduction on initial turbidity. All three coagulants completed turbidity reduction in approximately 30 minutes, however turbidity reduction by Maerua was 4.4% less than with Moringa. The initial decrease of bacteria count in water treated with alum or Moringa was of the same order. However, with Moringa there was a secondary bacterial increase probably due to growth on the organic matter from the seeds. (Seigler-IPA)
W79-09844

USE OF MICROORGANISMS IN COMBINATION WITH SURFACE ACTIVE AGENTS TO SYNERGISTICALLY DISPERSE OIL SLICKS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
For primary bibliographic entry see Field 5G.
W79-09930

MAGNETIC WATER CONDITIONER,
M. J. Brown.
U.S. Patent No. 4,146,479, 10 p, 13 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1415-1416, March 27, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, Demineralization, Cooling water, Scaling, Polarity, Magnets, Water conditioning.

A magnetic water conditioner has a hollow casing with an array of disc type cylindrical magnets arranged coaxially in the casing to provide an annular magnetic treatment zone in the space between the casing and the array. The magnets are polarized along diameters and have pole faces at their lateral surfaces, the magnets being rotatable about the axis of the array to various fixed positions that enable determination of the best field arrangement, all without any structural changes in the design of the conditioner. A plastic housing for the array provides parallel flow channels in the treatment zone, and which are all traversed by water fed to the zone by virtue of return passageways provided by molded end caps that also have openings which provide the inlet and outlet to the treatment zone. (Sinha-OEIS)
W79-09955

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY: SUMMARY REPORT,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09992

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME I: PLANNING CRITERIA,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09993

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 2: ENGINEERING CRITERIA,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 8B.
W79-09994

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS MANAGEMENT AREA, EMMA STUDY, VOLUME 3B: STUDY OF WASTES FROM LARGE INDUSTRIES,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09995

WASTEWATER ENGINEERING AND MANAGEMENT STUDY FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 3A: STUDY OF CERTAIN INDUSTRIAL WASTES.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09996

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 4: WATER ORIENTED WASTEWATER DISPOSAL CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09997

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 5: LAND ORIENTED WASTEWATER UTILIZATION CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09998

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 7: COMBINED SEWER OVERFLOW REGULATION,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 840, Price codes: A08 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, November 1975. 155 p, 17 fig, 16 tab, 6 app.

Descriptors: *Waste water treatment, *Massachusetts, *Combined sewers, *Storm drains, *Storm runoff, *Hydrologic models, *Waste water management, Separated sewers, Engineering structures, Hydraulic structures, Conveyance structures, Storm water, Surface runoff, Unit hydrographs, Artificial storms, Simulation, Water quality management, Boston(MA), Urban hydrology.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this volume is to evaluate the combined sewer overflow problem on the Boston Harbor area in terms of quantifying the problem and identifying the direction that technical, environmental and economic analysis should take during detailed facilities planning. The combined sewer service within the MDC system, the extent of the overflow problem and its effects on the Boston Harbor receiving waters are described.

Analysis criteria used in the computer simulation to determine quality and quantity of overflows are presented. Existing overflow pollution control facilities and recent studies concerning such facilities are described. Alternatives and their related costs are developed, along with results of modeling the Boston Harbor water quality. Finally, a plan of action is proposed. Recommendations include: accelerating municipal planning for combined sewer control; accelerated municipal programs for operation and maintenance and construction to control or eliminate combined sewer discharges; giving appropriate authority to combined sewer correction in the planning process and construction grants program; clarifying the types of treatment required; alleviating pollution from urban runoff in designing combined sewer correction systems and by encouraging local land management practices and regulatory measures; and achieving consistent policies and design standards for combined sewer correction programs. (See also W79-09992) (Zayac-NC)
W79-09999

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 8: URBAN STORMWATER MANAGEMENT,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 801, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 221 p, 55 fig, 24 tab.

Descriptors: *Waste water treatment, *Storm runoff, *Surface runoff, *Storm water, *Management, *Massachusetts, *Waste water management, Storm drains, Combined sewers, Drainage systems, Urban hydrology, Urban drainage, River basins, Storm structure, Artificial storms, Design storm, Planning, Runoff forecasting, Hydrographs, Water quality, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. The purpose of this volume is to prescribe cost-effective treatment measures for river basins and drainage areas in the EMMA area. A description is provided of the study area. Urban stormwater runoff is characterized by quality. The impact of this quality on receiving streams and collection and treatment facilities is described, then treatment objectives and methodology are outlined. Stormwater management plans for the study area include identification of urban stormwater runoff quality and quantity. Sources of pollution, its buildup and washoff are identified. This is incorporated into a mathematical model called 'STORM' which analyzes six components of the urban storm water cycle. The model is applied, using data on design storm rainfall, the antecedent dry period, land use and urban land surface characteristics. A methodology for stormwater management is described. Stormwater runoff-pollutograph relationships are highlighted. Alternatives for stormwater management are introduced and compared. Facilities are proposed, costs for management, capital, and operation and maintenance are summarized, and effects on receiving streams are described. Recommendations are made concerning further development of a stormwater management plan for Eastern Massachusetts. (See also W79-09992) (Zayac-NC)
W79-10000

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 8B.
W79-10001

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 10: DEER ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10002

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 11: NUT ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10003

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS, EMMA STUDY, VOLUME 12: FINANCING AND MANAGEMENT, PARTS 1 AND 2,
Peat, Marwick, Mitchell and Co., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-10004

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13: IMPACT ANALYSIS AND EVALUATION,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6G.
W79-10005

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13A: BIOLOGICAL IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6C.
W79-10006

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13B: SOCIO-ECONOMIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10007

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13C: HYGIENIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 811, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 185 p, 29 fig, 34 tab, 50 ref.

Descriptors: *Massachusetts, *Waste water treatment, *Public health, *Environmental sanitation, *Water quality, *Waste water management, Waste water(Pollution), Management, Environmental effects, Environmental engineering, Human pathology, Human diseases, Legal aspects, Potable water, Sanitary engineering, Social aspects, Water pollution, Regional analysis, Watershed management, Sludge, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this volume is to determine the potential impacts which implementation of each alternative concept for wastewater management may have on the public health of the study area. Existing conditions are first evaluated. Each watershed is described: major point and non-point discharges are inventoried; water quality is assessed; and effects of pollution on public health are outlined. Potential hygienic impacts or changes that may be caused by implementation of each of the five alternative plans is assessed. This impact assessment is concerned not only with elimination or magnification of potential direct causes of physical disease, but also with changes in environmental conditions affecting the social and mental well-being of the inhabitants. From a hygienic standpoint, Concept 1 is recommended. To ensure hygienic acceptability of Concept 6, the Study's Recommended concept, further study should be undertaken on effects of advanced treatment facility discharge to two of the study area rivers. An addendum provides background information on both public health hazards found in wastewater and sludge, and the effectiveness of various wastewater and sludge treatment processes in the removal of hazardous substances. (See also W79-09992) (Zayac-NC)
W79-10008

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13D: VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10009

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 14: PUBLIC INVOLVEMENT,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10010

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 15: RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10011

PORTABLE WATER FILTER,
Teledyne Industries, Inc., Fort Collins, CO. (Assignee).
T. Grimm, and D. Ewald.
U.S. Patent No. 4,151,092, 10 p, 10 fig, 21 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1393, April 24, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Filtration, Equipment, Taste, Odor, Portable equipment.

A portable water filter has a first container for holding a quantity of liquid to be treated. Mounted with respect to that container is a filter cartridge. A second container coupled to the cartridge is arranged to receive liquid pumped through the cartridge from the first container. Further included are means for manually pumping the liquid from the first container through the cartridge to the second container. In addition to its direct treatment of the liquid, the filtering material serves to remove undesired color, taste and odor induced by a disinfectant or bactericidal agent used with the system. (Sinha-OEIS)
W79-10077

5G. Water Quality Control

USER'S MANUAL FOR AGRICULTURAL RUNOFF MANAGEMENT (ARM) MODEL,
Hydrocomp Inc., Palo Alto, CA.
A. S. Donigian, and H. H. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 366, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-080, August, 1978. 163 p, 16 fig, 25 tab, 33 ref, 3 append.

Descriptors: *Agricultural runoff, *Model studies, Computer models, Computer programs, Simulation analysis, Hydrologic budget, Sediment load, Pesticide residues, Nutrient removal.

This user manual provides detailed instructions and guidelines for using the Agricultural Runoff Management (ARM) Model, Versions I and II. The manual includes a brief general description of the ARM Model structure, operation, and components, but the primary purpose of this document is to supply information, or sources of information, to assist potential users in using, calibrating, and applying the ARM Model. Data requirements and sources, model input and output, and model parameters are described and discussed. Extensive guidelines are provided for parameter evaluation and model calibration for runoff, sediment, pesticide, and nutrient simulation. Sample input sequences and examples of model output are included to clarify the tables describing model input and output. The manual also has discussed computer requirements and methods of analysis of the continuous information provided by the model. This manual, when used with an understanding of the simulated processes and the model algorithms, can provide a sound basis for using the ARM Model in the analysis of agricultural nonpoint pollution problems and management practices. (Skogerboe-Colorado State)
W79-09904

USE OF MICROORGANISMS IN COMBINATION WITH SURFACE ACTIVE AGENTS TO SYNERGISTICALLY DISPERSE OIL SLICKS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
R. R. Mohan, M. L. Robbins, A. I. Laskin, and L. A. Naslund.
U.S. Patent No. 4,146,470, 5 p, 9 tab, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1412, March 27, 1979.

Descriptors: *Patents, *Oil pollution, *Oily water, Water pollution treatment, Water quality control, Microorganisms, Surfactants, Dispersion, Oil slicks.

It has been found that there is a synergistic effect, resulting in rapid and efficient dispersion of intact cohesive oil films or slicks, when specified microorganisms are used in combination with various chemical surfactants. The use of the synergistic mixtures allows for a marked reduction in the quantity of chemical surfactant or detergent necessary for dispersion, resulting in benefits in terms of both more favorable economics and less potential upset to the environment and the ecology. (Sinha-OEIS)
W79-09930

V-SHAPED OIL CONTAINMENT BOOM,
Bennett Pollution Controls Ltd., Vancouver (British Columbia). (Assignee).
J. W. Steen, J. Bennett, and I. McAllister.
U.S. Patent No. 4,146,344, 7 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1373, March 27, 1979.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution control, Water quality control, Barriers, Floating, Containment, Oil booms.

An oil containment boom includes an elongated member of generally V-shaped cross-section, which is provided by a front wall section and a (preferably higher) read wall section, joined together along respective lower edges. Ballast means are provided for normally maintaining the elongated member upright with the joint between the front and rear walls at the bottom. Float means (preferably inflatable) are provided, which are placed between the front wall and the rear wall at a predetermined and preselected level above the joint. Drainage is provided within the front wall to permit polluted liquid which has rolled over the front wall and is trapped in the V-shaped member to escape to an area upstream of the front wall. A method of containing oil spills in ice infested water is also described. (Sinha-OEIS)
W79-09937

SYSTEM FOR COLLECTING OIL,
Yin-Lung Yang, Kangshan (Taiwan). (Assignee).
J. Y. Shyu.
U.S. Patent No. 4,146,482, 4 p, 3 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1416, March 27, 1979.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water quality control, Water pollution control, Barriers, Floating, Separation techniques, Containment, Gravity separation.

A dustpan-like collecting panel has two water proof floating tubes longitudinally mounted underneath the panel. This is for holding the panel floating on a sea surface inclined at a 15 to 20 degree angle. A 'U' shaped oil collecting tube having both ends sealed and several apertures cut into its top surface is mounted longitudinally underneath and abutted against the panel. An equal number of apertures are cut at the center line of the collecting panel to receive oil flowing from the apertures in the tube by the natural force of waves. A flexible pipe directs oil flow to a container where oil and water are separated automatically by gravity. (Sinha-OEIS)
W79-09969

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY: SUMMARY REPORT,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09992

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 1: PLANNING CRITERIA,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 793, Price codes: A14 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 386 p, 12 fig, 16 tab, 15 app.

Descriptors: *Massachusetts, *Model studies, *Projections, *Data collections, *Waste water management, *Comprehensive planning, *Planning criteria, *Sewerage projections, Analytical techniques, Population, Employment, Land use, Waste water(Pollution), Regional analysis, Methodology, Transportation, Water users, Calibrations, Data processing, Data transmission, Data storage and retrieval, Statistics, Industries, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This report covers the development of planning data for projecting sewerage needs. Projections of population, employment and land use for 1990, 2000, 2020 and 2050 are made. These projections are used to estimate future wastewater contributions. Regional projections are presented for population and economic activity. The methodology used for each is discussed, and for population projections an analysis is presented of the procedure for quantifying inputs to the Cohort Survival Model. Projections by others are reviewed. Alternative allocations of population and employment are outlined. An overview of the EMPIRIC model is provided. Before calibration, data are assembled in five categories for population, employment, water and sewer use, land use, transportation, major centers and inter-district distances. Model application is then assessed: preliminary small-area allocations are made, preparations for small-area forecasts are completed, and results are presented. Finally alternatives are analyzed and the preferred plan is selected. Fifteen appendices include data, reports and plans used in the study. (See also W79-09992) (Zayac-NC)
W79-09993

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS MANAGEMENT AREA, EMMA STUDY, VOLUME 3B: STUDY OF WASTES FROM LARGE INDUSTRIES,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09995

WASTEWATER ENGINEERING AND MANAGEMENT STUDY FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 3A: STUDY OF CERTAIN INDUSTRIAL WASTES.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09996

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 5: LAND ORIENTED WASTEWATER UTILIZATION CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 799, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 126 p, 19 fig, 29 tab, 2 app, 62 ref.

Descriptors: *Massachusetts, *Waste water disposal, *Waste water treatment, *Sludge treatment, *Costs, *Land treatment, *Waste water reclamation, *Land application, *Waste water management, *Sludge management, Land use, Waste water(Pollution), Regional analysis, Effluents, Conveyance structures, Sludge disposal, Capital costs, Construction costs, Cost analysis, Maintenance costs, Operating costs, Water reuse, Boston(MA), Rapid infiltration, Spray application, Collection facilities.

This is a part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume studies use of land application methods to further treat and make use of conventionally treated wastewaters. Potential land application areas are identified and acreage needs are determined. Relevant land use and geological data are presented and effluent qualities reviewed. The proposed land wastewater management system is then reviewed. The design of the regional facilities and the projected conveyance system are discussed. A discussion of the management of effluent application is presented and storage and drainage and collection facilities are identified. An investigation of two methods for treatment of wastewater effluents--spray irrigation and rapid infiltration--is provided. A proposed sludge management plan is discussed. Capital costs and annual operation and maintenance costs are presented. Future requirements are assessed. Conclusions indicate that land application treatment is a viable alternative for the area. Recommendations include selecting one or two areas to be used for demonstration projects, such projects being sufficiently large to use reclaimed water in a recreational pond or for cultural application. Appendices present data on geology and soils and identification of potential land application sites. (See also W79-09992) (Zayac-NC)
W79-09998

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 7: COMBINED SEWER OVERFLOW REGULATION,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5F.
W79-09999

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 8: URBAN STORMWATER MANAGEMENT,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10000

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS, EMMA STUDY, VOLUME 12: FINANCING AND MANAGEMENT, PARTS 1 AND 2,
Peat, Marwick, Mitchell and Co., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-10004

WASTEWATER MANAGEMENT PLAN. COLORADO RIVER AND TRIBUTARIES, TEXAS. SUMMARY,
Army Engineer District, Fort Worth, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 843, Price codes: A03 in paper copy, A01 in microfiche. September 1973. 43 p, 9 tab, 2 fig.

Descriptors: *Water quality, *Water resources, *Waste water management, *Water management(Administrative), *Colorado River Basin(TX), Water quality standards, Water pollution treatment, Water pollution sources, Water treatment, Water reuse, Waste water reclamation, Sewage treatment, Geology, Texas, Planning, Water resources planning, Legal aspects, Waste water treatment.

This volume of the Colorado River Basin Wastewater Management Plan serves as a summary and review of problem areas, study objectives, suggested alternative methods of solutions, recommended plans, general environmental assessment of the plan, and a means of plan implementation. The physical features of the study area are described. The report identifies the major water quality problem as one of stream imbalance caused by disproportionate amounts of secondary effluent and quality degradation caused by mineral salts from natural sources and oilfield operations. Future water quality problems may result from septic tank failures and greater municipal discharges from increased population. Waste water treatment strategies are discussed, with a short summary of each strategy. These alternatives range from flow regulation to water reuse to various combinations of alternatives. An evaluation and comparison of advanced biological treatment systems and physical/chemical treatment systems is summarized. These systems are compared along lines of environmental quality, social impacts, effect on economic development, technology, institutional arrangements needed, and effect on resource conservation. The report discusses the implementation of the water quality plan including funding, institutional arrangements, and alternatives. Recommendations include reclassification of stream segments, mostly to effluent limiting; ranking of dischargers, using primarily BOD loadings and concentrations; permit requirements and compliance schedules; control of residual wastes through issuance of waste control orders; and construction of cost-effective public treatment facilities to meet objectives of P.L. 92-500. (Coan-NC)
W79-10020

APPARATUSES TO SEPARATE A MIXTURE OF LIQUIDS OF DIFFERENT SPECIFIC GRAVITIES, E.G. OIL AND WATER,
Machinefabriek Geurtsen Deventer N.V., Deventer (Netherlands). (Assignee).
A. A. Geurtsen.
U.S. Patent No. 4,147,629, 5 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 239, April 3, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution control, *Separation techniques, Oily water, Specific gravity, Equipment.

An apparatus to separate a mixture of liquids of different specific gravities, e.g. oil and water is described in which in a settling vessel for liquids the buoyancy of the lighter liquid (oil) is used to move a diaphragm upwards to control the discharge of lighter liquid from the vessel. Means are provided to check temporarily or to slow down the downward movement of the diaphragm during the discharge. (Sinha-OEIS)
W79-10028

WATER CONTROL AND DISTRIBUTION APPARATUS,
Teledyne Industries, Inc., Fort Collins, CO. (Assignee).
S. Deines, G. L. Swiercinsky, and C. E. Engstrom.
U.S. Patent No. 4,147,631, 12 p, 15 fig, 17 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 240, April 3, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Filtration, Water quality control, Domestic water, Equipment.

A water filter apparatus includes a housing having a horizontally-disposed base unit. A coupling upstands from one end portion of the base unit and is attached to a faucet for receiving a supply of water. An outlet is directed downward from the base unit to discharge water received through the coupling. Also within the base unit is a valve that selectively permits the flow of water. Upstanding from another portion of the base unit is an inverted cup-shaped cap. An input fluid channel within the base unit leads from the valve to the chamber defined by the cap, and the valve selectively permits the flow of water through the coupling into the input channel and from that into the chamber. A filter cartridge within the cap has an inlet opening and an outlet opening so that water can flow through the cartridge and out of a spigot. A control regulates the flow of water and another regulates the flow rate. (Sinha-OEIS)
W79-10032

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 3.
Bureau of Reclamation, Phoenix, AZ.
Jan. 1979, 6 p. 12 fig.

Descriptors: *Water quality, *Water allocation(Policy), *Competing uses, *Equitable apportionment, *Central Arizona Project, Legal aspects, Administration, Water resources planning, Project planning, Municipal water, Industrial water, Irrigation water, Environmental effects, History, Arizona.

The allocation of Colorado River water, water quality in the Tucson area with the Central Arizona Project (CAP) and groundwater law are discussed in this third of a series of five summary information packets which describe the Central Arizona Project and related water and environmental issues. The three-tiered process by which Colorado River water is allocated is described although the eventual distribution of CAP water among Indian reservations, non-indian agriculturalists, and municipal and industrial users is still unresolved. Listed are a number of factors that will likely affect the final allocations, most of which focus upon how CAP water should be allocated between agricultural and municipal and industrial users. How the CAP will affect the quality of water in the Tucson area, which has long enjoyed relatively high quality water from its groundwater reservoirs, is analyzed here through a discussion of both Colorado River water quality which varies widely from year to year but is generally suitable for most uses, and water quality standards established by the U. S. Environmental Protection Agency, the Arizona water quality control council and the Arizona Department of Health Services. A brief history and discussion of Arizona groundwater legislation since 1864 is presented to illustrate that a multi-faceted approach is required in the formidable task of finding an equitable solution to groundwater allocations in the state. (See also W79-10060) (Tickes-Arizona)
W79-10062

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A MATHEMATICAL MODEL OF STRATIFIED, BIDIRECTIONAL FLOW IN SHORT CULVERTS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W79-09835

WATER IN A DEVELOPING WORLD: THE MANAGEMENT OF A CRITICAL RESOURCE,
Westview Special Studies in Natural Resources and Energy Management, Westview Press, Boulder, Colorado, 1978. 282 p, 5 fig, 2 tab, 224 ref. A. E. Utton and L. A. Teclaff, Eds.

Descriptors: *Water resources, *Management, *Water law, *Institutions, *Programs, *Design, *Evaluation, *Developing countries, Natural resources, Water utilization, Energy, Water rights, Legislation, Planning, Environmental control, River basins, Economics, Alternatives, de la Plata River(Argentina and Brazil), Political process, Water demand.

The availability or lack of water places a limit on human well-being in most areas of the world; as population continues to expand, our resources will have to be used more wisely. This book focuses on the questions of how best to manage water resources in the face of growing demand. The contributors discuss trends in water use, methods of establishing effective and flexible water management institutions, the changing direction of water resource planning, and the need for harmonizing water use with environmental concerns. The conflict between Argentina and Brazil over the de la Plata River is presented as an example of the need for cooperation in international resource planning. Various water management problems encountered by developing countries are explored in the final section, with emphasis on institutional and human factors that affect economic growth. Covered also are water resources program design and evaluation to serve the political process; and notes and comments, including riparian rights for federal in-stream flow, New Mexico's national forests and the implied reservation doctrine, and brief comments on the United Nations Water Conference. (Bell-Graf--Cornell)
W79-09849

ENVIRONMENTAL QUALITY AND RIVER BASIN DEVELOPMENT: A MODEL FOR INTEGRATED ANALYSIS AND PLANNING,
Organization of American States, Washington, D.C., 1978. 107 p, 17 fig, 4 tab, 66 ref, 4 append.

Descriptors: *River basin development, *Environment, *Planning, *Methodology, *Rio Bermejo(Argentina), Evaluation, Projects, Regional analysis, Benefits, Costs, Social aspects, Economic impact, Environmental effects, Water resources, Mathematical models, Systems analysis.

During 1970-1975, the Program of Regional Development of the Organization of American States and the Government of Argentina conducted regional development studies of the Bermejo River Basin in Northern Argentina. Presented is their methodology of river basin planning to consider the environmental ramifications of development in the basin. Included are comments on the relationship between environment, development, and river

basin planning. It is recommended that: (1) an environmental quality objective be included in the planning exercise; (2) environmental concerns receive explicit consideration; (3) the dynamics and interactions affecting the system be considered; that (4) interdisciplinary teams be involved; (5) the planning effort be closely coordinated with other planning entities having interest in the area; (6) the public participate; (7) alternatives be formulated, including some that do not foreclose other potential development options; (8) the adverse and beneficial inputs of proposed alternatives be assigned economic values where possible; and (9) the inputs be displayed for use by decision makers. It is suggested that environmental concerns are best cared for through integrated planning; a river basin planning methodology based on systems analysis is outlined. Presented is a model for the evaluation and display of environmental impacts which may be used at early planning stages. Compared is the methodology used in the Rio Bermejo investigations to that suggested by the pilot study. (Bell-Graf--Cornell)
W79-09850

REGULATION MODEL OF THE LAKE VELENCE RESERVOIR SYSTEM,
Technical Univ. of Budapest (Hungary). Dept. of Water Management.
K. Koris, and B. Nagy.
Journal of Hydrological Sciences, Vol. 5, No. 1, p 45-52, 1978. 2 fig, 19 ref.

Descriptors: *Lakes, *Regulation, *Reservoirs, *Recreation, *Water levels, *Optimization, *Loss minimization, *Stochastic processes, *Chance-constrained quadratic programming, Estimating, Mathematical models, Damages, Reservoir operation, Reservoir releases, Scheduling, Equations, Monthly, Continuity equation, Water supply, Planning, Water allocation(Policy), Lake Velence(Hungary).

This paper analyzes a water resources system in Hungary consisting of Lake Velence and two upstream reservoirs, the system's objective being to ensure optimum recreation conditions in the region surrounding the lake. The problem is to regulate the lake level to meet recreational demands. A chance-constrained stochastic quadratic programming model is utilized to estimate the magnitude of the damages accruing from the lake levels other than ideal (high and low), thereby minimizing the average value of the damages resulting from level fluctuations; the model minimizes losses and yields monthly releases for one year. (Bell-Graf--Cornell)
W79-09852

THE ROLE OF COMPUTERS IN TRANSFER OF WATER RESOURCE TECHNOLOGY,
New Mexico Inst. of Mining and Technology, Socorro.
V. P. Singh.
In: Water Knowledge Transfer, Vol. 1. Proceedings of the Second International Conference on Transfer of Water Resources Knowledge, June '77, Fort Collins. N.S. Grigg, et al., Eds., Water Resources Publications, Fort Collins, CO., 1978, p 540-556. 5 fig, 1 tab, 21 ref.

Descriptors: *Computers, *Water resources, *Technology, *Technology transfer, *Knowledge, Mathematical models, Systems analysis, Equations, Regions, Irrigation, Hydraulics, Rainfall-runoff relationships, Hydrology, Stanford watershed model.

The role of computers in the development of water resource technology is discussed and illustrated by citing specific real-world examples, including problems of irrigation hydraulics and of rainfall-runoff. Ramifications of computer technology in the transfer of water resources technology within a region and from one region to another are reviewed. The problems ordinarily experienced in such a transfer are identified. In conclusion, given propitious economical, political and sociological climate, transfer of technology from one region to another is not an impossible task, even though technical difficulties may be formidable. Computers can close or widen the technological gap between the regions, depending upon the above climate. (Bell-Graf--Cornell)
W79-09853

PROBABILISTIC WATER QUALITY CONTROL POLICIES,
Asian Inst. of Tech., Bangkok (Thailand).
B. N. Lohani, and N. C. Thanh.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers. Vol. 105, No. EE4, p 713-725, August 1979. 7 fig, 4 tab, 21 ref.

Descriptors: *Water quality control, *Water policy, *Probability, *Reliability, *Optimization, *Standards, *Dissolved oxygen, *Cost minimization, Biochemical oxygen demand, Mathematical models, Water management(Applied), Stochastic processes, Monthly, Operating costs, Constraints, Streamflow, Drainage basins, Systems analysis, Equations, Waste water removal, Taiwan.

A probabilistic programming model for regional water quality management in the Hsintien River in Taiwan is presented and found desirable for problems involving stochastic quantities. Four water quality management policies are studied for the requirement of maintaining a desired minimum dissolved oxygen level at all reaches of the river. In addition, a trade-off between the operating cost and degree of reliability for a target dissolved oxygen concentration at the Hsintien River has also been studied. Included is the monthly least-cost wastewater removal scheme for the Hsintien River, which shows significant savings in cost. (Bell-Graf--Cornell)
W79-09857

WATER QUALITY SAMPLING PROGRAMS IN RIVERS,
Melbourne Univ., Parkville (Australia). Centre for Environmental Studies.
For primary bibliographic entry see Field 5A.
W79-09859

MANAGEMENT OF WATER IN WESSEX,
Wessex Water Authority, Bristol (England).
J. K. Jackson.
Effluent and Water Treatment Journal, Vol. 17, No. 10, p 508-512, October 1977. 3 fig.

Descriptors: *Water management(Applied), *Wessex(Great Britain), *Planning, *Reorganization, Water supply, Water demand, Water resources, River basins, Benefits, Sewerage, Economics.

Reorganization of the water industry in England and Wales occurred on April 1, 1974, largely as a result of pressure from those within and without the industry who recognized the need for more effective management of water to meet increasing and frequently competing demands for water uses. Although for those commissioned with the task it is reassuring that the recent Government White Paper on the review of the industry supported the principle of river basin management as a central feature to be retained, it is nevertheless believed that some 3 years after reorganization there will be those who seek to learn of steps taken at regional level towards the prime aims of reorganization. Wessex Water Authority has introduced a fully multifunctional management system and this paper seeks to outline developing Wessex concepts of water management, to describe steps being taken with particular reference to water resources, and to emphasize the benefits deriving from corporate management over the whole field of the Authority's activity. (Bell-Graf--Cornell)
W79-09861

A COMPARATIVE CASE STUDY OF DYNAMIC MODELS FOR DO-BOD-ALGAE INTERACTION IN A FRESHWATER RIVER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5A.
W79-09862

ON THE MONETARY VALUE OF AN ECOLOGICAL RIVER QUALITY MODEL,
Nuclear Research Center, Karlsruhe (Germany, F.R.).
H. Stehfest.
Publication No. RR-78-1, International Institute for Applied Systems Analysis, Laxenburg, Austria, June 1978. 24 p, 7 fig, 11 ref.

Descriptors: *Water pollution control, *Waste water treatment, *Dynamic programming, *Decision making, *Optimization, *Cost minimization, *Streeter-Phelps model, *Rhine River(Fed Rep Germany), Economic efficiency, Monetary benefits, Mathematical models, Equations, Systems analysis, Measurement, Simulation analysis, Standards, Planning, Constraints, Probability, Ecological model.

Investigated by means of an example is the degree of complexity a water quality model should have if it is used for water quality management. A least-cost control problem for the Rhine River is solved for both a simple Streeter-Phelps model and a more complex ecological model. Using dynamic programming, the optimum distribution of waste water treatment effort on the river is derived such that standards of oxygen and nondegradable pollutants concentration are met. The differences between the optimal solutions (corresponding to the two models) are remarkable, but not as large as one might expect from the differences in the model structure. For the choice between the two optimum solutions, in which subjective aspects are encountered, a formal procedure is proposed which finds the solution with the lowest expected cost. (Bell-Graf--Cornell)
W79-09863

PROCEDURE FOR THE ECONOMICAL EVALUATION OF WATER NETWORKS' PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
G. Oron, and D. Karmeli.
Water Resources Bulletin, Vol. 15, No. 4, p 1050-1060, August 1979. 3 fig, 14 ref.

Descriptors: *Networks, *Optimization, *Branch and bound method, *Geometric programming, *Water systems, *Cost minimization, Design, Constraints, Decision making, Pipes, Capital, Investment, Mixed-integer problems, Irrigation systems, Nonlinear equations, Systems analysis.

Water systems may be described by a set of mostly nonlinear equations, and the variables involved are either continuous or discrete. Generalized Geometric Programming is used herein to solve for least-cost values and the 'Branch and Bound' technique is used to express the variables in integer forms, as required for water systems. These two mathematical techniques are combined to produce an optimization method that solves nonlinear, mixed integer constrained problems. A solution for a water system problem is presented, wherein the problem is to determine the minimum cost pipe network variables for irrigation. (Bell-Graf--Cornell)
W79-09866

A MULTIOBJECTIVE MODEL FOR REGIONAL WATER QUALITY MANAGEMENT,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
B. N. Lohani, and P. Adulbhan.
Water Resources Bulletin, Vol. 15, No. 4, p 1028-1038, August 1979. 1 fig, 6 tab, 12 ref.

Descriptors: *Water quality control, *Optimization, *Regional management, *Multiobjectives, *Cost minimization, *Goal programming, *Effluent standards, Dissolved oxygen, Biochemical oxygen demand, River basins, Constraints, Streams, Equations, Mathematical models, Systems analysis, Linear programming, Waste treatment.

Linear programming is the simplest of all the optimization techniques used in regional water quality management studies; but the technique can optimize only one goal. When there are multiple goals with the same or different priorities, goal programming is a useful decision-making tool. This article illustrates the application of goal programming to a

regional water quality management problem where the following two goals are considered: (1) minimize the total cost of waste treatment; and (2) maintain the water quality goals (dissolved oxygen) close to the minimum level stated in the stream standards. (Bell-Graf--Cornell)
W79-09867

MODELING WATER DISTRIBUTION IN SANTA CLARA COUNTY, CALIF.,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 4A.
W79-09877

USER'S MANUAL FOR AGRICULTURAL RUNOFF MANAGEMENT (ARM) MODEL,
Hydrocomp Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5G.
W79-09904

HEURISTIC DECISION RULES FOR WATER RESOURCES PLANNING,
Kannert Graduate School of Management, Lafayette, IN.
V. Akileswaran, T. L. Morin, and W. L. Meier, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 578, Price codes: A12 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No. 119. August 1979. 263 p, 6 fig, 3 tab, 195 ref, 5 append. OWRT B-086-IND(1).

Descriptors: *Planning, *Methodology, *Decision making, Multipurpose projects, *Optimization, *Heuristics.

For the practical field level many of the analytical techniques advocated for water resources planning and management are too sophisticated to be used. This report addresses and develops the significance and importance of heuristics applicable to field-level water planning and management activities. The analysis focuses primarily on the capacity expansion planning problem which is formulated as a combinatorial optimization problem. In order to justify theoretically that for such combinatorial problems 'good' exact solution techniques may never be found, and that at present heuristics provide the only means for treating many such difficult combinatorial problems, the concept of 'NP completeness' is introduced. A survey was made of relevant work and the various mathematical programming solution methodologies are critically reviewed. Most of these techniques require excessive amounts of computational and analytical resources, more than for most planning agencies. Thus, several new usable heuristics and relaxations are proposed. The development and analysis of the optimality of these heuristics is outlined. The heuristics are tested and their performance evaluated on data from a number of real-world problems. The heuristics are so simple to apply that they have been implemented on hand-held calculators for which programs are provided in the report.
W79-09962

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 8B.
W79-10001

A LAND-USE PLANNING MODEL FOR COASTAL ZONE MANAGEMENT,
State Univ. of New York at Stony Brook. Coll. of Engineering and Applied Sciences.
E. Beltrami, and T. O. Carroll.
Coastal Zone Management Journal, Vol. 4, Nos. 1/2, p 83-96, January-February, 1978. 4 fig, 3 tab, 4 ref.

Descriptors: *Planning, *Land use, *Linear programming, *Mathematical models, *Water pollution sources, *Coastal zone management, *Nassau County(NY), *Suffolk County(NY), Water pollution, Water quality, Biochemical oxygen demand, Long Island(NY).

A model is presented for estimating the pollution concentrations in a coastal area resulting from aggregate impact of land use activity in areas adjacent to a shoreline. The methodology is intended to be useful to regional planners, and is based on a study conducted for the Long Island area. The model attempts to explain average, steady-state pollution concentrations by measuring emissions into water from industrial, residential, commercial and other land use activity in pounds per acre per year of BOD and nitrates; by measuring coastal impacts of these pollutants in parts per million (ppm) concentrations in coastal waters; and by assigning different 'transport' coefficients to these flows of emissions to represent their relative ease or difficulty in flowing into coastal waters. Model formulation was based upon the assignment of zones to the subject area and building in the plan for preservation of some land in each zone for future use. For the subject area, using measurement of pollutant concentration along the dimensions of existing and future planned land spatial configurations, land-use rearrangements allowed in the planning process, and predicted recharge activity and planned dredging projects for the area, BOD and nitrate pollutant transport coefficients were generated which yielded between 60-84 lb/year/acre of BOD runoff for higher density residential, industrial and commercial uses to 0-24 lb/year/acre for farm and open recreation uses. (Arnold-NC)
W79-10015

6B. Evaluation Process

WATER DEVELOPMENT IN WYOMING: A SURVEY OF RESIDENT ATTITUDES, 1971,
Wyoming Univ., Laramie. Water Resources Research Inst.
J. C. Parker, C. Phillips, and S. E. Ferguson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 495, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, (1979). 45 p, 10 fig, 4 tab, 2 append. OWRT A-004-WYO (1), 14-31-0001-3551.

Descriptors: *Social aspects, *Public opinion, *Attitudes, Water resources development, *Wyoming.

The attitudes of Wyoming residents toward water resource development and their priorities for water use were surveyed in 1971. The survey covered general priorities, specific trade-offs between various development options, and potential problems. The 560 individuals responding to the questionnaire represented a full range of occupations, educational backgrounds, and income levels; every county in the state was represented, including residents of communities of all sizes and of rural areas. Responses are presented and discussed by both absolute and relative frequency; they were also cross-tabulated by age, education, income level, occupation, and residence class size. Agricultural use is the concept of water development ranked most important by one-third of the residents surveyed; in a binary ordering of uses, agriculture was preferred to all other uses, recreation to all but agriculture, and municipal over industrial uses. Wyoming residents generally feel that the state's streams have 'some' pollution, and they ranked planning and development most important of the water problems that the state will face in the near future. Among the findings of a series of questions surveying public participation in the decision-making process, more than two-thirds of Wyoming residents belong to a group that is concerned in some way with water issues.
W79-09833

ANALYSIS OF INVESTMENTS IN TECHNOLOGY DEVELOPMENT AND RESOURCE CONSERVATION,
Princeton Univ., NJ. School of Engineering and Applied Science.
B. S. Verkhovsky, and M. Sniedovich.
Advances in Water Resources, Vol. 1, No. 3, p 131-139, March 1978. 2 fig, 20 ref, 2 append.

Descriptors: *Water resources, *Technology development, *Conservation, *Capital, *Investment, *Methodology, *Economic analysis, Decision making, Research, Optimization, Dynamic programming, Decomposition technique, Industries, Mathematical models, Constraints, Equations, Systems analysis, Algorithms, Resource allocation.

An optimization methodology is presented for the economic analysis of capital investments in research, technology development and water resources conservation. The role of technology development and resource conservation is directly related to the availability of resources. Mathematically speaking, the problem is one in which part of the control variables are investments on technologies related to the manufacturing of diverse products. The methodology enables the decision maker to distribute efficiently restricted amounts of capital and resources to the different manufacturing systems so as to achieve the most profitable combination of production levels. Using the so-called 'technology function,' the solution procedure consists of a combination of decomposition and dynamic programming. The specific technology functions are considered as examples and it is shown how analytical consideration can be incorporated in the solution procedure so as to reduce computational requirements. Possible extensions of the problem are discussed. (Bell-Graf--Cornell)
W79-09854

NATIONWIDE COST OF WET-WEATHER POLLUTION CONTROL,
Florida Univ., Gainesville.
J. P. Heaney, W. C. Huber, R. Field, and R. H. Sullivan.
Journal of the Water Pollution Control Federation, Vol. 51, No. 8, p 2043-2053, August 1979. 4 fig, 6 tab, 20 ref.

Descriptors: *Methodology, *Cost analysis, *Simulation analysis, *Water pollution control, *Isoquants, *Runoff, *Wet-weather pollution, Optimization, Storm water, Reservoir storage, Water treatment, Waste water treatment, Comparison, Equations, Mathematical models, Systems analysis.

A generalized method for evaluating the optimal mix of storage and treatment for any desired level of wet-weather pollutant control was developed. The final assessment results for the entire U.S. indicate that the initial capital investment for 25, 50, 75 and 85% biochemical oxygen demand control is $2,476 million, $7,391 million, $22,744 million, and $41,968 million based on 85% of present worth of total annual cost at an assumed interest rate of 8% over 20 years. Incremental costs for wet-weather control increase significantly because of the disproportionately larger control units needed to capture the less frequent, larger storms. The results indicate significantly lower control costs than reported in earlier studies. (Bell-Graf--Cornell)
W79-09858

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 4A.
W79-09860

INCOME DISTRIBUTION IMPACTS OF A WATER DEVELOPMENT PROJECT--BOISE PROJECT, IDAHO, 1950-1970,
Idaho Univ., Moscow.
E. S. Boydstun, T. Nelson, and R. B. Long.
Water Resources Bulletin, Vol. 15, No. 4, p 1086-1095, August 1979. 2 fig, 4 tab, 7 ref.

Descriptors: *Water resources development, *Income distribution, *Idaho, *Effects, *Projects, *Income growth, Evaluation, Irrigation water, Water supply, Rural areas, Comparison, Western US, United States, Gini ratios, Average income, Lorenz curves.

Public investments in water resources development projects need continual examination in terms of economic, environmental, and social impacts. The results of an analysis of a water development project that supplies irrigation water in Idaho are discussed as to the impact on income distribution and income growth 44 to 64 years after the project was initiated. Gini ratios for the rural farm population of these counties were consistently lower than they were for the United States as a whole and for the state of Idaho. Additionally, income distribution tended to become more equitable over time in the water project counties. Rural farm population income growth rates were found to be similar to those for the nation as a whole. Some of the reasons for these results may be related to the tendency for income distribution to become more equitable as income increases and to the fact that average farm size is relatively small. (Bell-Graf--Cornell)
W79-09865

COMPARATIVE EVALUATION OF STATISTICAL METHODS FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-09870

AN ANALYTIC APPROACH TO SCHEDULING PIPE REPLACEMENT,
Howard (Charles) and Associates Ltd., Winnipeg (Manitoba).
U. Shamir, and C. D. D. Howard.
Journal of the American Water Works Association, Vol. 71, No. 5, p 248-258, May 1978. 11 fig, 1 tab, 4 ref, 2 append.

Descriptors: *Pipes, *Economic analysis, *Scheduling, *Forecasting, *Effects, *Costs, Failure rate, Cost data, Discount rate, Breaks, Repair, Replacement, Regression analysis, Equations, Systems analysis, Cost-benefit analysis, Timing.

A procedure is described that uses the history of main breaks to forecast how the number of breaks would change with time if the pipe were not replaced; a separate analysis predicts the failure rate of newly installed pipes. These forecasts are combined with cost data and a discount rate that accounts for inflation to determine the optimal replacement data. The article considers an analysis of break data, and an economic analysis and results are presented. The economic analysis uses the following basic components: (1) the forecasted number of breaks in future years in the existing pipe; (2) the forecasted number of breaks in the new pipe, as a function of the time from its installation; (3) the cost of repairing one break; (4) the cost of replacing the existing pipe with a new one; and (5) the discount rate which should be used in converting future expenditures into present value. The economic analysis developed herein is simple to calculate and can be programmed for a hand-held calculator. (Bell-Graf--Cornell)
W79-09879

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13: IMPACT ANALYSIS AND EVALUATION,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6G.
W79-10005

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13A: BIOLOGICAL IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6C.
W79-10006

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13B: SOCIO-ECONOMIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 810, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 214 p.

Descriptors: *Massachusetts, *Social aspects, *Social impact, *Economic impact, *Economics, *Waste water treatment, *Waste water management, Employment, Recreation, Economic justification, Costs, Capital costs, Cost analysis, Income, Land use, Agriculture, Forestry, Municipal finance, Recreation, Commerce, Pulp and paper industry, Textiles, Food processing industry, Boston(MA), Housing, Metals, Chemical industry.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This volume analyzes socio-economic conditions for each of five proposed wastewater service concepts. Eight substantive areas are reviewed: housing; industrial activity; recreational opportunity; commercial activity; agriculture and forestry; municipal finance; and employment and income. Because so many of the treatment plants and interceptor networks proposed are common to all five concepts, differential impacts on local land use are not substantial. For land application, it was found that since most disposal sites are quite remote from existing and planned development centers, adverse impacts would be minimized. In relatively unsewered areas lying in rapid growth corridors, potential impact upon residential growth can be large; the new facilities could exercise a 'triggering' effect on future residential development. In areas experiencing less rapid growth, public health of existing residential areas is expected to be improved. Local zoning and other policies are recommended to minimize disruptions. Industry, recreational activity, commercial activities, agricultural output, and employment and income will all be affected by implementation of any of the five concepts. (See also W79-09992) (Zayac-NC)
W79-10007

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13D: VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 812, Price codes: A12 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 275 p, 3 app.

Descriptors: *Waste water treatment, *Massachusetts, *Aesthetics, *Waste water management, *Impact analysis, *Visual-cultural impacts, *Design impacts, Social aspects, Methodology, Recreation, Sewer systems, Boston(MA), Open space, Landscapes, Development patterns.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume identifies and assesses the potential visual, cultural and design impacts resulting from the implementation of any of the five regional concepts for wastewater treatment in the study area. The report recognizes that it will most likely raise more issues and questions than it will address and attempt to answer; the full value of this study is seen in its use in combination with other assessments as part of an overall screening and review process. Baseline conditions regarding development patterns, landscape character, open space and recreation, existing sewer systems, and concept proposals are first summarized. A methodology is presented and visual, cultural and design impacts for each concept are assessed. Conclusions, recommendations and comments by region and by site help formulate a preferred concept (Concept 2), and a selected concept (Concept 1 with recommended modifications). An appendix presents site-specific baseline data and matrix forms. (See also W79-09992) (Zayac-NC)
W79-10009

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 14: PUBLIC INVOLVEMENT,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 813, Price codes: A09 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 181 p.

Descriptors: *Massachusetts, *Planning, *Waste water management, *Waste water treatment, *Methodology, *Public participation, Institutions, Coordination, Management, Programs, Social aspects, Water quality, Boston(MA), Citizens, Public involvement, Public meetings, Workshops, Media participation.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume reviews open planning in the EMMA study. It evaluates how the state, EPA, the Corps of Engineers, the Metropolitan Area Planning Council and a Citizens' Committee have worked together in a wastewater management study. The effort to encourage public response to planning data and assumptions as well as five different concepts for wastewater management are outlined. The strategy for public involvement is first reviewed. Issues are enumerated and perspectives of the various involved entities described. Components of the program are analyzed--committees, public meetings, briefings and workshops, informal contacts, media and written materials. A chronological record of events and their relation to plan formulation is presented. Finally, the participants' views of the program are gleaned from comments by citizens' committees, letters, newspaper clippings and written statements received at the final meetings. (See also W79-09992) (Zayac-NC)
W79-10010

A COMPARISON OF EVALUATIONS OF FOUR IRRIGATION PROJECTS,
H. B. R. Beale.
Growth and Change, Vol. 9, No. 3, p 22-28, July, 1978. 5 tab.

Descriptors: *Benefit-cost analysis, *Project benefits, *Irrigation projects, *Water resources development, *Cost analysis, *Cost comparisons, *Feasibility studies, *Budget studies, Reservoirs, Water projects, Economics, Agriculture, Cost allocation, Econometrics, Project planning, Benefit-cost theory, Emery County(UT), Little Wood River(ID), Paonia(CO, Smith Fork(CO).

This article analyzes land value budget studies by citing an example of different cost evaluation techniques which could be applied to Bureau of Reclamation small reservoir projects. The four projects studied are Emergy County (UT), Little Wood River (ID), and Paonia and Smith Fork (CO). The author suggests that Bureau of Reclamation projects are often uneconomic and that the Bureau budget studies of such projects are not adequate. Two methods of evaluation of porject benefits are compared--the standard Bureau of Reclamation evaluation, which counts as benefits assessed value of land improvements and uses a higher interest rate of return; and the land valuation method, which does not assess land improvements as benefits and which calculates a lower, closer to present 'market' rate of return on project benefits. The author asserts that the latter method of evaluation is a more realistic one and, if used, would result in

far fewer such Bureau projects. Further, the standard Bureau evaluation method does not define key variables, such as benefit/cost and internal rate of return, precisely enough to give accurate estimates of them. Budget studies themselves are discussed in terms of their potential strengths (e.g., general consistency of direct benefit estimation) and weaknesses (e.g., use of too low an interest rate by the Bureau). (Arnold-NC)
W79-10019

THE ECONOMIC VALUE OF IRRIGATION WATER IN THE WESTERN UNITED STATES,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
B. R. Beattie, M. D. Frank, and R. D. Lacewell.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management, Proceedings, ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division Specialty Conference, Virginia Polytechnic Institute and State University, July 26-28, 1978. p 572-581, (1978) ASCE, New York. OWRT A-034-TEX(2).

Descriptors: Economics, *Irrigated agriculture, *Water values, Social values, Irrigation water.

This paper addresses several issues pertinent to the economics of western irrigated agriculture. Estimates of the marginal value of water for the major irrigated regions of the 17 contiguous western states are reported. The sensitivity of these values to changes in farm product prices and pumping costs is discussed. Several myths for assigning agricultural water a social value in excess of farmer's ability-to-pay are presented and dispelled. The paper concludes with some thoughts on the future viability of irrigated agriculture in the West.
W79-10023

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER TREATMENT PLANTS: 1973-1977.
Dames and Moore, Denver, CO. Water Pollution Control Engineering Services.
For primary bibliographic entry see Field 5D.
W79-10080

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WHAT PRICE, REJECT HEAT,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
E. McBean, D. Haycock, and J. Gorrie.
Water Resources Bulletin, Vol. 15, No. 3, p 684-691, June 1979. 2 fig, 6 ref.

Descriptors: *Waste heat, *Greenhouses, *Pricing, *Energy, Estimating, Electric powerplants, Nuclear powerplants, Economic feasibility, Agriculture, Equations, Ontario(Canada), Water resources.

Increasing energy costs encourage more efficient energy use, including the better use of reject heat from electrical generating stations. Whether it pays to use this heat depends upon the price charged. There is to date no relevant market in Canada. This paper estimates lower and upper bounds on the price for reject heat as a first step in determining market feasibility. Price would then be resolved by negotiation. For the case study of Ontario greenhouses, the differential between lower and upper bounds is substantial. An assumed price resolution is consistent with profitable use of this reject heat by this greenhouse industry. (Bell-Graf--Cornell)
W79-09868

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13A: BIOLOGICAL IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 809, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 145 p, 17 fig, 21 tab.

Descriptors: *Massachusetts, *Environmental effects, *Biology, *Ecology, *Wastewater treatment, *Water quality, *Waste water management, Planning, Methodology, Environmental control, Data collections, Data transmission, Discharge(Water), Sediments, Biota, Water pollution, Boston(MA), Ocean discharges, Freshwater discharges, Land application, Impact assessment.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume evaluates the impact of the proposed treatment facilities so that environmental consequences might be weighted against economic costs. Existing environmental data are evaluated and the need for further environmental data collections are identified. The subsequent charge is then to specify appropriate environmental criteria for use in evaluating the ecological impacts of the plans considered. Existing environmental data are first inventoried. An annotated bibliography is included. Water quality, sediments and biota are discussed. A summary of existing conditions by hydrological region is presented. Recommendations for further study are made, including new approaches, supplemental information and dissemination of available data. Assumptions and critical information concerning freshwater and ocean discharges, land application, and other important considerations are reviewed. An impact assessment methodology is introduced. Evaluation of wastewater management alternatives is presented for no action alternative and each of six plans considered. Finally, an evaluation of impacts of individual treatment facilities is made. (See also W79-09992) (Zayac-NC)
W79-10006

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 15: RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10011

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 2.
Bureau of Reclamation, Phoenix, AZ.
Jan. 1979, 4 p. 4 fig.

Descriptors: *Water costs, *Cost allocation, *Construction costs, *Economic feasibility, *Central Arizona Project, Associated costs, Financing, Marketing, Project planning, Economic justification, Economic impact, History, Arizona.

The cost and economics of the Central Arizona Project (CAP) including the repayment of project costs and irrigation assistance are described in this second of a series of five summary information packets which describe the Central Arizona Project and related water supply and environmental issues. Repayment of the CAP costs to the Federal treasury, most of which will be paid over the life of the project through charges for the water delivered, involves the following factors: (1) How the repayment obligation is established, (2) who will repay the costs, (3) what the source of the revenues is, and (4) when the repayment will begin. A separate discussion of each of these factors is followed by a short history of the laws affecting the Bureau of Reclamation to document that the concepts and procedures outlined are not unique to the CAP but reflect water resource development policy since 1939. Some of the major factors considered in determining the economic viability of the CAP are discussed. (See also W79-10060) (Tickes-Arizona)
W79-10061

6E. Water Law and Institutions

WATER IN A DEVELOPING WORLD: THE MANAGEMENT OF A CRITICAL RESOURCE,
For primary bibliographic entry see Field 6A.
W79-09849

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS, EMMA STUDY, VOLUME 12: FINANCING AND MANAGEMENT, PARTS 1 AND 2,
Peat, Marwick, Mitchell and Co., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 806, Price codes: A10 in paper copy, A01 in microfiche, and AD-A036 807, Price codes: A14 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. Part 1 - 192 p, Part 2 - 291 p.

Descriptors: *Massachusetts, *Financing, *Management, *Institutions, *Planning, *Waste water treatment, *Waste water management, Administration, Organizations, Methodology, Cost analysis, Legislation, Financial feasibility, Bond issues, Institutional constraints, Treatment facilities, Government, Boston(MA), Communities, Funding, Agencies.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. These two volumes contain the study's management phase. The purpose is to evaluate and recommend modifications to the organizational and financial structures required to manage, fund and operate the recommended systems. Profiles of 12 metropolitan area sewerage agencies were prepared to serve as a benchmark against which to compare the delivery of wastewater treatment services. Current operations of MDC are reviewed, comparing its organizational structure against other metropolitan agencies. The influence of institutional and non-institutional pressures are examined. Barriers to goal attainment, and the implications of no change in the institutional network on the level and quality of wastewater services are described. A methodology for analyzing treatment facilities and costs is presented and alternative apportionment and allocation techniques are outlined; feasible alternatives are evaluated. The recommended organizational alternative is described as well as the legislative program required to implement the recommended structure. The approved methodology for apportioning and allocating costs is summarized and applied to historical and projected cost data to determine the relative cost impact on communities. Bonding alternatives are presented and a recommended structure is incorporated into the cost allocation to communities. (See also W79-09992) (Zayac-NC)
W79-10004

MARKET MODELS FOR WATER POLLUTION CONTROL: THEIR STRENGTHS AND WEAKNESSES,
S. Rose-Ackerman.
Public Policy, Vol. 25, No. 3, p 383-406, Summer 1977. 28 ref.

Descriptors: *Water quality, *Water pollution, *Water pollution control, *Regulation, *Pollution charges, *Federal Water Pollution Control Act, *Pollution rights, Water policy, Law enforcement, Discharge, Waste treatment, Legal aspects, Taxes, Environmental quality, Equity, Uncertainty, Market mechanisms, Public policy.

Two market schemes are examined for controlling water pollution--effluent charges and pollution rights. The Federal Water Pollution Control Act of 1972 is described with the changes needed to make it more effective. The major change is allowing for less costly alternatives to meet water quality goals. To enact more efficient market pricing solutions, the author describes necessary revisions of the 1972 Act. The market perspective is difficult to implement because any attempt to use monetary

incentives in pollution control must face squarely the inevitable difficulty of legislating a market into being when preconditions for this market do not exist. Problems arise in three major areas: (1) liability for pollution damage may be unclear; (2) the relationship between ambient water quality and waste discharge is not simple; and (3) the marginal cost of an additional recreational user of water is zero. The two alternatives for introducing market incentives are evaluated with regard to several criteria: time and uncertainty, emergencies, simple versus complex systems, municipalities and market schemes, collusion by dischargers, enforcement, and uniformity and market schemes. A critique of the overstated advantages of market mechanisms is offered along with general conclusions concerning their advantages. Pollution rights are preferred to charges because they: (1) assure the attainment of water quality thresholds; (2) minimize inequities; (3) provide a means of subsidizing municipalities without sacrificing efficiency; (4) permit growth without burdening existing dischargers; and (4) provide a way to handle emergencies. (Coan-NC)
W79-10016

WASTEWATER MANAGEMENT PLAN. COLORADO RIVER AND TRIBUTARIES, TEXAS. SUMMARY,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 5G.
W79-10020

6G. Ecologic Impact Of Water Development

ANTHROPOLOGICAL INVESTIGATIONS NEAR THE CREST OF THE CONTINENT, 1975-1978,
University of Southern Colorado, Pueblo. Dept. of Anthropology.
W. G. Buckles, B. L. Woodward, N. B. Buckles, K. E. Adams, and B. R. Miller.
Edited by Buckles, W. G., Volumes I, II, and III, November 1978. Prepared for the Bureau of Reclamation, Lower Missouri Region. 1139 p, 163 fig, 55 tab, 294 ref.

Descriptors: *Archeology, *History, *Colorado, Irrigation, Diversion, Environmental effects, Mining, Recreation, Geologic history, Dating, Stratigraphy, Time.

Archeological, historical, and paleontological resources in an area near the Continental Divide in Colorado relative to the Fryingpan-Arkansas Project were inventoried, evaluated, and mitigated. The project will divert water flow from the western slope of the Continental Divide to the eastern slope for irrigation, industrial use, and municipal use. Of the 259 sites studied, 132 had historical components. Approximately 10,000 years of prehistoric occupation are represented. Most sites have mixed components, but two sites had resources in unmixed contexts and were dated at AD. 1 - AD. 1000 and 4,200 years old respectively. Differences in solar radiation availability and other environmental and cultural variables were considered when analyzing patterns of historic site distribution, function, and other attributes. Probabilistic sampling was used to assess sampling strategies useful for other similar studies. Attributes of the sites were analyzed as patterns (locational, temporal, functional, and behavioral). To explain historic patterns and processes, syntheses of the systemic relations between industrial, environmental, site, behavorial, and other patterns were analyzed. (Seigler-IPA)
W79-09840

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13: IMPACT ANALYSIS AND EVALUATION,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 808, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 144 p, 10 fig, 7 app.

Descriptors: *Massachusetts, *Planning, *Evaluation, *Waste water management, *Impact analysis, Waste water treatment, Comprehensive planning, Project planning, Projections, Administration, Coordination, Decision making, Governments, Institutions, Legislation, Management, Programs, Regional developments, Social aspects, Alternative planning, Boston(MA), Public participation, Environmental impacts.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume documents the Corps' impact assessment effort as part of the development of alternatives for the study area. Both beneficial and adverse aesthetic, biological, hygienic and socio-economic impacts resulting from the various proposed alternatives for wastewater management are considered. The first part of this report defines the basis for impact assessment in the planning process. Used is the Water Resources Council's Principles and Standards, which establishes a framework for formulation and evaluation of Federal water and related land resources projects. The report next shows the relationship between tasks performed by the study team and those specified in Principles and Standards. Discussed are: identification of goals and objectives, input of goals into the development of wastewater management alternatives; impact analysis; public participation; and requirements of Public Law 92-500. A summary of the various impact analyses and an evaluation of impacts in relation to both study and Federal goals and objectives is provided. Results of the impact analyses will be used in the final Environmental Impact Statement for the study's Recommended Plan. (See also W79-09992) (Zayac-NC)
W79-10005

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13B: SOCIO-ECONOMIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10007

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13C: HYGIENIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10008

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13D: VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10009

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 5.
Bureau of Reclamation, Phoenix, AZ.
Feb. 1979, 6 p. 8 fig.

Descriptors: *Central Arizona Project, *Environmental effects, *Recreation facilities, *Wildlife conservation, Balance of nature, Environmental control, Wildlife management, Resources development, Project planning, National Environmental Policy Act, Arizona, Aqueducts.

The relationship of the Central Arizona Project (CAP) to the National Environmental Policy Act (NEPA), the Endangered Species Act, and the development and management of recreation facilities are described in this, the last in a series of five summary information packets which describe the Central Arizona Project and related water supply and environmental issues. CAP features for which individual statements or other NEPA compliance documents have been or will be prepared are the: (1) Granite Reef aqueduct, (2) Salt-Gila aqueduct, (3) Indian distribution system, (4) Tucson division, (5) regulatory storage division, (6) Buttes Dam and Reservoir, and (7) water allocation process. Each of these features or actions is discussed in terms of the status of the environmental process and the identified or anticipated major environmental concerns associated with each feature or action. The Endangered Species Act requires federal agencies to conduct a biological assessment on listed species in the projects area. Although there are presently no federally listed endangered species within the Tucson division study area, the desert tortoise and one species of plant, Cheilanthes pringlei, have both been proposed for listing. Three options for developing recreational facilities under the Federal Water Project Recreation Act enacted in 1965 are outlined. (See also W79-10060) (Tickes-Arizona)
W79-10064

RURAL WATER DEVELOPMENT IN ARID REGIONS,
Intermediate Technology Development Group, London (England).
P. H. Stern.
Progress in Water Technology, Vol. 11, No. 1, p 21-23, 1978. 1 tab, 4 ref.

Descriptors: *Water resources development, *Water supply development, *Area redevelopment, *Regional development, *Water supply, *Arid lands, Comprehensive planning, Social aspects, Water utilization, Pastoralism, Groundwater resources, Surface water resources, Water availability, Water requirements, Rural areas, Ethiopia.

The general characteristics of the arid regions of the world, including the very limited water resources, necessitate special adjustments for human habitation. The relationship between the pastoral communities in these harsh areas and the available surface and groundwater resources are discussed here in terms of water requirements and particular measures needed to meet them, particularly those relating to official failure to recognize the relationship between pastoralists and their herds and the impact of such relationships on the community's water needs. The examples cited from the Ogaden desert region of Ethiopia illustrate in microcosm the necessity of intermediate technology approaches to problems of water supplies in such situations. (Tickes-Arizona)
W79-10065

ASPECTS OF ENVIRONMENTAL HEALTH IMPACTS OF THE ASWAN HIGH DAM ON RURAL POPULATION IN EGYPT,
Michigan Univ., Ann Arbor. School of Public Health.
F. D. Miller, M. Hussein, K. H. Mancy, and M. S. Hilbert.
Progress in Water Technology, Vol. 11, No. 1/2, p 173-180, 1978. 3 fig, 2 tab, 33 ref.

Descriptors: *Human diseases, *Environmental effects, *Public health, *Trematodes, Epidemiology, Water pollution effects, Dam construction, Schistomiasis, Regional development, Egypt, Aswan High Dam.

The widespread speculation that schistosomiasis, a disease which has long been a health problem in Egypt, would be greatly increased as a result of the construction of the Aswan High Dam or the related expansion of irrigation is examined here by means of an environmental and epidemiological survey of 15,329 rural Egyptians selected from the three major geographical regions of the Nile Valley and from the resettled Nubian population. Estimates based upon these and previous survey findings suggest that although a steady decline in the prevalence of this disease is clearly indicated since the 1930s, a minimum of 6.9 million Egyp-

tians are infected with either S. mansoni or S. haematobium or both, with the prevalence of infection being highest in the Nile Delta and decreasing from north to south. It is concluded, however, that there is sufficient historical and current data to firmly disregard any role of the Aswan High Dam in causing an increase in Schistosomiasis in rural Egypt. (Tickes-Arizona)
W79-10066

7. RESOURCES DATA

7B. Data Acquisition

PROCEEDINGS OF THE SYMPOSIUM ON THE RECOVERY OF INDICATOR ORGANISMS EMPLOYING MEMBRANE FILTERS,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 587, Price codes: A10 in paper copy, A01 in microfiche. Held at the meeting of the American Society for Testing and Materials, Committee D-19 on Water, January 20-21, 1975, Fort Lauderdale, Florida. Report EPA-600/9-77-024, September 1977. 200 p, 1 append.

Descriptors: *Membranes, *Membrane processes, *Filters, *Bioindicators, *Coliforms, Analytical techniques, Testing procedures, Laboratory tests, Testing, Water analysis, Waste water treatment, Sewage bacteria, Municipal wastes, Industrial wastes, Design standards.

Topics discussed at the Symposium are categorized under the subjects of general papers, stressed/injured cells and observed effects on membrane filter recovery, comparisons of membrane filter lots and brands, and answers to apparent low recoveries. Problems associated with the use of membrane filters for water and waste water analyses and the recovery of bacterial indicators are most pronounced in fecal coliform tests. Media, transport kinetics, physical and chemical properties of membranes, membrane sterilization techniques, incubation temperatures, comparative methodologies, and proposed ASTM standards for evaluations of membranes are discussed. Two-step incubations, enrichment methods, and modifications for membrane filter structures are some of the resulting suggestions for improving indicator recovery. Standardization of testing procedures is also discussed. (See also W79-09882 thru W79-09900) (Lisk-FRC)
W79-09881

THE MEMBRANE FILTER DILEMMA,
Environmental Monitoring and Support Lab., Cincinnati, OH.
R. H. Bordner.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p. 8-11, 1977. 6 ref.

Descriptors: *Membrane processes, *Filtration, *Bioindicators, *Testing procedures, *Membranes, Specifications, Materials, Testing, Water quality control, Water quality standards, Materials testing, Waste water treatment.

Problems associated with the recovery of indicator organisms from water and waste water and requirements for improving membrane filter (MF) procedures are reviewed. The objectives of Symposium regarding MF technology are also listed. The utilization of MF processes in water quality control and in microbiological analyses is discussed and water and waste water standards and criteria are reviewed. Recent enforcement legislation and the importance of quality assurance methods are discussed. The American Society for Testing and Materials has developed preliminary test procedures for evaluating membrane filters and recovery of indicator organisms. (See also W79-09881) (Lisk-FRC)
W79-09882

PERFORMANCE VARIABILITY OF MEMBRANE FILTER PROCEDURES,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
E. E. Geldreich.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 12-19, 1977. 51 ref.

Descriptors: *Membrane processes, *Filtration, *Performance, *Fabrication, *Pores, Porosity, Materials, Water analysis, Bioindicators, Waste identification.

Variabilities in the performance of membrane filter processes may be attributed to variations in the manufacture, absorbent pad impurities, sterilization procedures, media inconsistencies, and improper performance of membrane filter process applications to water analyses. The historical development of membrane filters is reviewed. Pores should be uniformly distributed on the membrane filter and should have diameters of 0.45 micron; pores larger than 0.7 micron will not retain indicator organism groups. Filter porosity of 0.22 micron permits complete bacterial separation from liquids. Other parameters discussed regarding membrane filters include the grid ink properties, physical structure of the membrane, chemical composition, and sterilization techniques. Variabilities in the membrane filter tests and special membrane filter application considerations are also reviewed. (See also W79-09881) (Lisk-FRC)
W79-09883

QUALITY CONTROL OF MEMBRANE FILTER MEDIA,
BioQuest, Cockeysville, MD.
D. A. Power.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 20-28, 1977. 10 ref.

Descriptors: *Membranes, *Filters, *Fabrication, *Materials testing, *Quality control, Physical properties, Chemical properties, Performance, Bioindicators, Testing procedures, Cultures, Water quality.

Considerations and factors in the quality control of membrane filter media by both the manufacturer and the user are reviewed. Manufacturers investigate the raw materials incorporated into the dehydrated media prior to formulation of membrane filter media. The dehydrated products are also checked for suitable physical and chemical properties, microbial contamination, and growth support; dehydrated materials are also subjected to performance testing with specific media. Quality control procedures and considerations for the user in the laboratory include: the age of the product, storage conditions, accurate weighing, distilled water quality, clean instruments, mixing and solution factors, controlled heating, accurate pH calculations, supplement quality, and appropriate testing with stabilized test cultures. Monitoring the appearance, pH, sterility, and membrane performance with selected test organisms is also recommended for the resulting media. A discussion of the report is also included. (See also W79-09881) (Lisk-FRC)
W79-09884

STATISTICAL INTERPRETATION OF MEMBRANE FILTER BACTERIA COUNTS,
Millipore Corp., Bedford, MA.
K. J. Sladek, C. F. Frith, and R. A. Cotton.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 26-33, 1977. 2 fig, 3 tab, 4 ref.

Descriptors: *Coliforms, *Membranes, *Analytical techniques, *Statistical models, *Sewage bacteria, Statistical methods, Design criteria, Testing procedures, Water quality analysis, Waste water treatment.

The various methods and statistical designs for enumerating bacteria by membrane filters are reviewed. The use of large numbers of replicates can increase the precision of mean counts and in fecal coliform tests, the use of water samples stabilized by dilution in phosphate buffered peptone can result in large numbers of replicates. Precision of the counts may also be increased by reducing the scatter among replicates. Even in well mixed samples, variations in bacterial density produce a lower limit of scatter which is predictable as the theoretical minimum standard deviation and may be compared with experimentally derived standard deviations. The effects of ethylene oxide sterilization, other sterilization techniques, and agar thickness are evaluated. To prevent the interference of unexpected variables with results, experimental designs should incorporate randomization of procedural variables. (See also W79-09881) (Lisk-FRC)
W79-09885

EFFECT OF INJURY ON THE RECOVERY OF INDICATOR BACTERIA ON MEMBRANE FILTERS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
A. W. Hoadley.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 34-41, 1977. 6 fig, 2 tab, 11 ref.

Descriptors: *E. coli, *Streptococcus, *Membranes, *Selectivity, *Sewage bacteria, Membrane processes, Pollutant identification, Analytical techniques, Cultures, Filters, Water quality analysis, Waste water treatment, Chlorination.

Injury to indicator bacteria during aqueous suspension or by contact with chlorine has been shown to adversely affect colonization on membrane filters incubated on selective media. Both Trypticase soy agar and membrane filters incubated on M-FC medium at 44.5 C performed equally well in the recovery of dividing cells of Escherichia coli, but recovery efficiency decreased with time of exposure to stress. A recovery efficiency of less than 50% was observed for Streptococcus faecalis in aqueous suspension recovered on membrane filters incubated in KF agar and on M-Enterococcus agar; recovery did not decrease with time of suspension. It is recommended that a media be formulated which permits colonization of viable cells. (See also W79-09881) (Lisk-FRC)
W79-09886

EFFECTS OF TEMPERATURE ON THE RECOVERY OF FECAL COLIFORMS,
Missouri Univ.-Rolla. Dept. of Life Science.
J. B. Hufham.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 42-45, 1977. 5 tab.

Descriptors: *E. coli, *Membranes, *Filtration, *Thermal stress, *Analytical techniques, Testing procedures, Coliforms, Sewage bacteria, Performance testing, Cultures, Water quality analysis, Waste water treatment.

The differential effects of temperature on various types of membrane filters and on the recovery of fecal coliforms were investigated. Various types of membranes have exhibited recovery rates for pure cultures of E. coli of known densities ranging from 10-70%. Other variables in the recovery of E. coli include medium, temperature, and the organism itself which must be a pure culture, easy to obtain, E. coli, and not selected for by the M-FC procedure. Results of the study indicated that incubation of E. coli at 44.5 C destroyed about 40% of the cells, even in the absence of a membrane filter. Incubation at 35 C resulted in good differentiation between E. coli and E. aerogenes by M-FC techniques. Millipore membranes inhibited about 50% of the cells, attributed to a heat soluble factor. Incubation on Millipore membranes at 44.5 C selected for mutants capable of surviving under these conditions. The establishment of a test strain of E. coli was recommended and better correlation of plate counts at different temperatures was urged. (See also W79-09881) (Lisk-FRC)
W79-09887

OPTIMUM MEMBRANE STRUCTURES FOR GROWTH OF FECAL COLIFORM ORGANISMS,
Millipore Corp., Bedford, MA.
K. J. Sladek, R. V. Suslavich, B. I. Sohn, and F. W. Dawson.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 46-57, 1977. 7 fig, 2 tab, 6 ref.

Descriptors: *Coliforms, *Membranes, *Design criteria, *Pores, *Surfaces, Retention, Membrane processes, Material testing, Physical properties, Analytical properties, Techniques.

An investigation was made of the optimum structure and properties of membrane filters for the recovery of fecal coliforms. Other parameters affecting coliform recovery on membrane filters were studied and included sterilization techniques and membrane composition. The characteristics of the membrane filter which significantly influence the growth of fecal coliforms were evaluated with various samples. The most critical factor in coliform recovery was the surface pore morphology. Significant increases in fecal coliform counts were observed with increasing surface opening sizes. The optimum growth of fecal coliforms occurred when the surface openings of the membrane structures were large enough to surround entrapped bacteria. The chemical composition of the membrane also had an impact on the growth of coliforms. Membranes composed of mixed esters of cellulose having a surface opening diameter of 2.4 micrometers and a retention pore size of 0.7 micrometers exhibited the maximum fecal coliform recoveries. (See also W79-09881) (Lisk-FRC)
W79-09888

A COMPARISON OF MEMBRANE FILTERS AND MEDIA USED TO RECOVER COLIFORMS FROM WATER,
Ontario Ministry of Health, Toronto. Lab. Services Branch.
M. H. Brodsky, and D. A. Schieman.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 58-63, 1977. 6 tab, 5 ref.

Descriptors: *Coliforms, *Membranes, *Filters, *Analytical techniques, *Cultures, Evaluation, Testing, Performance, Laboratory tests, Water pollution, Water quality analysis.

Three membrane filters manufactured by different companies for the recovery and enumeration of coliforms in water were compared. Parallel analyses were performed with membrane filters supplied by Johns-Manville Company of Canada (045 MO 47SG), Millipore Corporation (HAWG 47SO), and Sartorius Company (11456). The study also compared the performance of LES Endo agar and M-Endo broths with agar added. Laboratories performed 82 comparisons between the Johns-Manville and the Sartorius filters and 68 comparisons between the Johns-Manville and Millipore filters. Two phases of the study used routine water samples while a third phase utilized water samples from a known polluted river. Results of the three phase studies did not correlate but statistical evaluation of the results indicated that Johns-Manville and Millipore membrane filters were equivalent and superior to the Sartorius filters for the enumeration of coliforms. No significant difference between coliform recovery on the two culture media studied. (See also W79-09881) (Lisk-FRC)
W79-09889

COMPARISON OF MEMBRANE FILTERS IN RECOVERY OF NATURALLY INJURED COLIFORMS,
Montana State Univ., Bozeman. Dept. of Microbiology.
D. G. Stuart, J. E. Schillinger, and G. A. McFeters.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 64-66, 1977. 7 ref.

Descriptors: *E. coli, *Membranes, *Cultures, *Evaluation, *Sewage, Filters, Analytical techniques, Statistical methods, Natural streams, Water quality analysis, Waste water treatment.

The recovery and enumeration of E. coli in raw sewage and cultures utilizing the M-FC test with and without enrichment and with different brands of membrane filters were performed. The membrane filters compared were Millipore, Gelman, and Nuclepore; M-Endo MF medium at 35 C was used for E. coli experiments and M-FC fecal coliform medium at 44.5 C was used for sewage samples. Natural injury to the coliforms was performed by 24 hrs exposure to a natural aquatic environment. Enrichment was provided by a mixture of Trypticase soy broth, 0.5% glucose, and 0.3% yeast extract. Significant differences among the 3 filters were observed at the 0.01 level for sewage and the 0.005 level for E. coli with Millipore and Gelman providing similar results. ANOVA, F and t statistics indicated that Gelman had a very slight advantage over Millipore recovery. Comparisons of the enriched and nonenriched cultures indicated that the washed E. coli cells were more sensitive to filter and test variations than raw sewage coliforms. The use of Nuclepore membrane filters was not recommended. (See also W79-09881) (Lisk-FRC)
W79-09890

EFFICIENCY OF COLIFORM RECOVERY USING TWO BRANDS OF MEMBRANE FILTERS,
Environmental Protection Agency, Kansas City, KS. Surveillance and Analysis Div.
F. L. Harris, and C. A. Bailey.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 67-72, 1977. 3 tab, 6 ref.

Descriptors: *Membranes, *Filters, *Coliforms, *Material testing, *Cultures, Membrane processes, Quality control, Evaluation, Sewage bacteria, Analytical techniques, Testing procedures, Sewage effluents, Streams.

Gelman and Millipore filters were compared for the recovery of coliforms from nonchlorinated aerobic lagoon influent and effluent, river water, and sewage treatment plant effluent. A total of 100 aqueous samples were tested on 0.45 micrometer porosity membrane filters. The Gelman filters recovered 2.5 times more fecal coliform bacteria than the Millipore filters when the same samples and processing techniques were employed. Recovery of total coliforms was similar for the two test filter brands. Confirmation of the fecal coliform colonies was performed by subculturing 10 randomly picked blue colonies on other culture media. (See also W79-09881) (Lisk-FRC)
W79-09891

COMPARISON OF MEMBRANE FILTER BRANDS FOR RECOVERY OF THE COLIFORM GROUP,
National Marine Water Quality Lab., Narragansett, RI.
A. P. Dufour, and V. J. Cabelli.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 73-81, 1977. 8 tab, 2 ref.

Descriptors: *Membranes, *Filters, *E. coli, *Sewage bacteria, *Testing procedures, Coliforms, Analytical techniques, Membrane processes, Cultures, Sampling, Water quality control.

Millipore, Gelman, Sartorius, Schleicher and Schuell, and Nuclepore filters were compared for the recovery of E. coli, K. pneumonia, and Enterobacter cloacae from natural waters utilizing the M-FC test procedure. Recoveries of pure cultures or natural source fecal coliforms were not significantly affected by the brand of membrane filter, except in the case of Nuclepore filters. With natural water samples, the variability of the recovery increased. The filter brand did affect the precision of the M-FC test. (See also W79-09881) (Lisk-FRC)
W79-09892

A COMPARISON OF MEMBRANE FILTERS, CULTURE MEDIA, INCUBATION TEMPERATURES, POLLUTED WATER AND ESCHERICHIA COLI STRAINS IN THE FECAL COLIFORM TEST,
Pennsylvania State Univ., University Park. Dept. of Veterinary Science.
P. J. Glantz.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 82-97, 1977. 9 tab, 12 ref.

Descriptors: *E. coli, *Membranes, *Filters, *Cultures, *Analytical techniques, Sewage bacteria, Evaluation, Testing procedures, Membrane processes, Temperature, Coliforms, Water quality control.

Millipore, Gelman, and Sartorius membrane filters were compared for the recovery of fecal coliforms and E. coli isolated from polluted water. The effects of temperature on bacterial growth were investigated with incubation temperatures of 35, 43, and 44.5 C. Actual E. coli counts were obtained with Trypticase soy agar and were compared with counts on M-FC and violet red bile agar. Bacteria grew better on the violet red bile agar than on the M-FC medium and was not always affected by 44.5 C incubation temperature. The E. coli strains grew better on the membrane filters than on the poured agar plates. The strain of E. coli, the growth method utilized, and the temperature inside the plate influenced the usefulness of the membrane filter for the fecal coliform test. (See also W79-09881) (Lisk-FRC)
W79-09893

RECOVERY CHARACTERISTICS OF BACTERIA INJURED IN THE NATURAL AQUATIC ENVIRONMENT,
Montana State Univ., Bozeman. Dept. of Microbiology.
G. K. Bissonnette, J. J. Jezeski, G. A. McFeters, and D. G. Stuart.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 98-100, 1977.

Descriptors: *E. coli, *Streptococcus, *Environmental effects, *Cultures, *Growth rates, Membranes, Filters, Membrane processes, Selectivity, Analytical techniques.

Stress induced by the aquatic environment on indicator bacteria was evaluated as a potential cause of injury which can prevent identification and enumeration by direct selective techniques. Membrane chambers were filled with Escherichia coli or Streptococcus faecalis, immersed in different stream sites, and sampled daily. Organisms were grown in Trypticase soy agar and desoxychloate agar to determine the maximum number of recoverable organisms and the number of bacteria capable of forming colonies on selective medium. Results of the study indicated that the recovery and enumeration of the organisms were adversely affected by some of the conditions at the test sites. Additional tests were also conducted on the efficiency of various selective media in the recovery of E. coli that were debilitated in natural water; liquid media were found more effective than broth plating or membrane filtration techniques for recovering E. coli and S. faecalis. A third study evaluated the capacity of injured cells to repair themselves in the presence of a suitable environment. Results indicated that brief exposure of the cells to a rich, non-selective medium prior to the use of a selective medium resulted in significant repair from environmental injury. Membrane filtration procedures were especially suitable for this procedure. (See also W79-09881) (Lisk-FRC)
W79-09894

A LAYERED MEMBRANE FILTER MEDIUM FOR IMPROVED RECOVERY OF STRESSED FECAL COLIFORMS,

R. E. Rose, E. E. Geldreich, and W. Litsky.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 101-108, 1977. 6 tab, 13 ref.

Descriptors: *Analytical techniques, *Coliforms, *Membrane processes, *Sewage bacteria, *Water pollution sources, Chlorination, Filters, Quality control, Testing procedures, Sewage effluents.

A method developed for the improved recovery of stressed fecal coliforms on membrane filters utilizes a two layered agar method with temperature acclimation, lactose enrichment, and diffusion transfer into M-FC agar. Samples of raw and chlorinated waste water and reservoir, river, and marine waters were used in field tests at three laboratories. The two layer technique verified 1013 typical blue colonies from a total of 61 water samples for an average verification rate of 92%. The two layer technique exhibited a higher sensitivity for fecal coliforms in chlorinated secondary effluents, marine waters, and natural water containing pollutants with heavy metal ions, compared to direct M-FC methods. (See also W79-09881) (Lisk-FRC)
W79-09895

MEASUREMENT OF FECAL COLIFORMS IN ESTUARINE WATER,
A. P. Stevens, R. J. Grasso, and J. E. Delaney.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 109-112, 1977. 1 fig, 1 tab, 2 ref.

Descriptors: *Coliforms, *Analytical techniques, *Membranes, *Membrane processes, *Testing procedures, Cultures, Estuarine environment, Filters, Bioindicators, Laboratory tests, Water quality control, Pollutant identification, Incubation.

Standard membrane filter (MF) procedures and standard most probable number EC (MPN) counts were compared for the recoveries of fecal coliforms from estuarine waters. A two-step procedure was developed in which the fecal coliforms are acclimated prior to exposure to the selective temperature of 44.5 C. A minimal holding agar, containing tryptose, dextrose, lactose, oxgall, sodium chloride, and agar, is allowed to warm to room temperature prior to placement of the membrane filter on the agar. The dishes are sealed, placed in a plastic bag and inverted in a water bath at 25 C for about 18 hrs. The membranes are then transferred to absorbent pads in sealed dishes that have been saturated with M-FC broth (about 1.7-1.8 ml broth/pad). The dishes are reincubated at 44.5 C for 24 hrs. This procedure recovered about 85% of the MPN count compared to about 24% by the standard MF technique. The procedure obtained 93% verification of the colonies. Further studies revealed that the batches and brands of membrane filters significantly affected the recovery of fecal coliforms in estuarine water. (See also W79-09881) (Lisk-FRC)
W79-09896

EVALUATION OF METHODS FOR DETECTING COLIFORMS AND FECAL STREPTOCOCCI IN CHLORINATED SECONDARY SEWAGE EFFLUENTS,
Illinois State Water Survey, Peoria. Water Quality Section.
S. Lin.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 113-132, 1977. 13 fig, 10 tab, 34 ref.

Descriptors: *Membrane processes, *Chlorination, *Coliforms, *Streptococcus, *Cultures, Analytical techniques, Sewage bacteria, Laboratory tests, Testing procedures, Pollutant identification, Disinfection, Waste water treatment, Water quality control.

Membrane filter and most probable number (MPN) methods were used for the recovery of fecal coliforms, total coliforms, and fecal streptococci from chlorinated secondary sewage effluents. Comparable results for recovering total coliforms were obtained by the LES two-step membrane filter technique and the MPN procedure. The LES two-step method detected 1.5-fold more total coliforms than the M-Endo one-step membrane filter procedure. The MPN technique recovered more fecal coliforms than the M-FC membrane filter technique. The M-Enterococcus agar procedure with bile broth enrichment or extended incubation for 3 days produced fecal streptococci recoveries comparable to the MPN technique; the M-Enterococcus agar two day incubation procedure was not enhanced by the use of either azide dextrose broth, brain-heart infusion broth, or peptone yeast-extract Casitone. Results of the study were considered useful for evaluating the efficiency of disinfection practices for waste water treatment plants utilizing chlorination. (See also W79-09881) (Lisk-FRC)
W79-09897

THE ASTM PROPOSED MEMBRANE FILTER TEST PROCEDURE FOR THE RECOVERY OF FECAL COLIFORMS,
Microbe One, Ann Arbor, MI.
M. J. Jackson, D. W. Davis, and G. R. Kinzer.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 133-152, 1977. 1 fig, 4 tab, 8 ref.

Descriptors: *Analytical techniques, *Testing procedures, *Membrane processes, *Filters, *Cultures, Laboratory tests, Coliforms, Sewage bacteria, Water pollution, Water analysis, Membranes.

A comparison of various membrane filters for the recovery of fecal coliforms was conducted with Sartorius, Gelman, John-Mansville, Oxoid, Millipore, and S and S filters. Four samples of polluted water and one raw sewage sample were used in the tests; samples were incubated on M-FC agar at 44.5 C for 22-24 hrs. Samples were also tested on M-FC agar by the pour plate or the spread plate technique and replicate counts were compared with counts on the membrane filters. Nine laboratories participated in the experiments and their results indicated differences in filter brands and in resulting laboratory data. Further tests were considered necessary to eliminate variables. (See also W79-09881) (Lisk-FRC)
W79-09898

CRITIQUE ON ASTM TEST FOR RECOVERY OF FECAL COLIFORMS AND PROPOSAL FOR MODIFIED METHOD,
Sartorius Membrane Filter (Germany, F.R.).
N. H. Goddard.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 153-156, 1977.

Descriptors: *Analytical techniques, *Coliforms, *Testing procedures, *Membranes, *Filters, Design standards, Cultures, Bioindicators, Laboratory tests, Testing, Water analysis, Laboratory equipment.

Recommendations for the standardization of fecal coliform recovery on membrane filters are presented. These include: the use of a flora more favorable in sewage than polluted waters, such as potable water spiked with a pure culture; standardization of sample mixing conditions; separation of coliform and non-coliform counts; randomization of sample positions during incubation; and verification of thermometer and incubator settings. Also, results of a routine method must be comparable to results of other methods such as a pour plate method and must be reproducible independent of the testing laboratory or the person performing the test. The medium should be selective and not interfere with the identification of the colonies. The method should also be simple, practical, and useable in any testing laboratory. (See also W79-09881) (Lisk-FRC)
W79-09899

COMPARISON OF MEMBRANE FILTER COUNTS AND PLATE COUNTS ON HETEROTROPHIC AND OIL AGAR USED TO ESTIMATE POPULATIONS OF YEAST, FUNGI AND BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, B. F. Conrad, P. A. Seesman, and R. R. Colwell.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 178-187, 1977. 15 tab, 4 ref.

Descriptors: *Membranes, *Yeasts, *Fungi, *Marine bacteria, *Analytical techniques, Membrane processes, Filters, Performance, On-site tests, Testing procedures, Water analysis.

Membrane filter and plate counts of yeasts, fungi, and bacteria on heterotrophic and oil agar were compared. The membrane filters were found to consistently yield higher counts of years and fungi than plate counts. Filter counts were about 80% lower than plate counts for recovery of heterotrophic estuarine and marine bacteria. Millipore filters were found to be sturdier and easier to use than Nuclepore filters for field work. (See also W79-09881) (Lisk-FRC)
W79-09900

8. ENGINEERING WORKS

8A. Structures

APPARATUS AND METHOD FOR CONTROLLING TIDE WATERS,
E. A. Salo.
U.S. Patent No. 4,146,346, 5 p, 7 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1374, March 27, 1979.

Descriptors: *Patents, *Tidal waters, *Tidal streams, Saline water intrusion, Tidal effects, Water control, Weirs, Floating, Structures.

The salinity intrusion of ocean tidewater into a communicating fresh water river is prevented by laterally restricting the out-flow cross-section of the river with a series of flotation weirs and control weirs so that the surface level of the out-flow cross-section is higher than the surface level of the adjacent tidal salt water. The weirs are located so as to not obstruct the ship channel of the river. (Sinha-OEIS)
W79-09938

POWER PRODUCTION AT FEDERAL DAMS COULD BE INCREASED BY MODERNIZING TURBINES AND GENERATORS.
General Accounting Office, Washington, DC. Energy and Minerals Div.
For primary bibliographic entry see Field 8C.
W79-09991

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 1.
Bureau of Reclamation, Phoenix, AZ.
Nov. 1978, 8 p. 13 fig.

Descriptors: *Central Arizona Project, *Water resources development, *Multiple purpose projects, *Project purposes, *Water allocation(Policy), *Water supply, Structures, Comprehensive planning, Legislation, History, Regional development, Water law, Water conservation, Legal aspects, Distribution systems, Arizona, Aqueducts, Water storage, Conveyance structures.

The history, description, status and water supply of the Central Arizona Project (CAP) are described here in the first of a series of five summary information packets designed to increase public awareness of the CAP and related water supply and environmental issues. Colorado River water, a valuable commodity in the arid west, has been the subject of intense political negotiations, scientific engineering investigations, and legal debate spanning decades. A summary of these historical issues is presented with a separate description of the many related parts of the CAP including the Gran-

ite Reef aqueduct, Salt-Gila aqueduct, Tucson aqueduct, Buttes Dam and Reservoir, Salt-Gila regulatory storage, Indian distribution systems and other authorized features. Discussions of the sufficiency of Colorado River flows to service CAP diversions and the extent to which CAP water will affect Tucson area water supplies indicate that as CAP deliveries increase, Pima County can begin to balance its water use with available annual supplies if other measures, such as retirement of farmland, re-use of sewage effluent, conservation programs, etc. are applied. Although the many related parts of the CAP are due to be completed at different times, water delivery to the Tucson area is scheduled for 1987 and to the Phoenix area in 1985. (See W79-10061 thru W79-10064) (Tickes-Arizona)
W79-10060

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 4.
Bureau of Reclamation, Phoenix, AZ.
Jan. 1979, 6 p. 7 fig, 1 tab.

Descriptors: *Water storage, *Water resources planning, *Energy conservation, *Central Arizona Project, *Subsidence, *Groundwater resources, Future planning(Projected), Project planning, Energy budget, Environmental effects, Water supply, Aqueducts, Conveyance structures, Groundwater mining, Arizona.

Central Arizona Project (CAP) energy use, subsidence and earth fissures related to groundwater pumping and the regulatory and terminal storage of CAP water are described in this fourth in a series of five summary information packets which describe the Central Arizona Project and related water supply and environmental issues. Large CAP energy requirements are supplied from a portion of the Navajo Generating Capacity purchased expressly for this purpose and efforts are currently underway to determine methods of operating the project in an energy-conserving manner. These efforts and naturally occurring variations in CAP operating capacity will result in the production at times of power in excess of project needs. It is expected that this power can be marketed to customers in the southwest. Subsidence and earth fissuring due to extensive use of groundwater in Arizona are problems that can only be stopped by achieving a balance between groundwater pumpings and recharge. Although the CAP is expected to aid in reducing this problem, more information about the conditions under which these phenomena take place is needed. The needs for and value of regulatory and terminal storage facilities are well documented although sites for the development of such facilities have yet to be selected on the CAP system. The Bureau of Reclamation and U. S. Army Corps of Engineers are in the initial stages of studying this problem. (See also W79-10060) (Tickes-Arizona)
W79-10063

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER TREATMENT PLANTS: 1973-1977.
Dames and Moore, Denver, CO. Water Pollution Control Engineering Services.
For primary bibliographic entry see Field 5D.
W79-10080

8B. Hydraulics

FLOW MONITORING,
Pro-Tech, Inc., Paoli, PA. (Assignee).
K. W. Martig, Jr.
U.S. Patent No. 4,145,926, 5 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1233, March 27, 1979.

Descriptors: *Patents, *Monitoring, *Measurement, *Flow, Sewerage, Combined sewers, Open channels, Depth, Sensors.

A method is provided for monitoring liquid flow in an open pipe or conduit. A sensor is located adjacent the invert or at the inside of the bed and the depth of liquid is determined by the bubbler method. To minimize interferences with the liquid flow the bubble fluid is conducted from the exterior along the inside wall and to the vicinity of the flow bed in the pipe or conduit. The sensor and the bubble fluid conductor are retained in place by supporting means adapted to be expanded into secure frictional engagement with the inside wall of the pipe or conduit. The flow is determined by releasing the bubble fluid bubble-wise against the static pressure of the overlying liquid, sensing such pressure, indicating it in terms of liquid depth, and converting depth to flow by conventional methods. (Sinha-OEIS)
W79-09936

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 2: ENGINEERING CRITERIA,
Metcalf and Eddy, Inc., Boston, Mass.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 794, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 142 p, 18 fig, 19 tab, 2 append.

Descriptors: *Costs, *Massachusetts, *Design criteria, *Waste water treatment, *Sanitary engineering, Design standards, Connstruction, Engineering structures, Specifications, Effluents, Cost analysis, Sludge treatment, Sewers, Outfall sewers, Pumping plants, Tunnels, Infiltration, Inflow, Boston(MA), Waste water management.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. It covers the engineering criteria used in proposed projects, including the bases of estimating wastewater flows, sewerage needs and costs. Projections of sewerage needs and wastewater flow are made for each community. Dry weather waste water flows are first investigated. The population and economic area served are reviewed and area sewering explained. Total annual volumes of water consumption are calculated and sewage flows are developed. A flow quantification procedure is outlined. Major and other industrial flows are reviewed and peak flows studied; a composition of process wastewaters is presented. An infiltration/inflow analysis looks at both the Nut Island and Deer Island Treatment Plant flows. An infiltration allowance procedure is outlined and allowances are selected. Treatment criteria are analyzed and design parameters discussed. Finally, cost bases are reviewed for different facilities. Two appendices present analyses on infiltration and salt water intrusion. (See also W79-09992) (Zayac-NC)
W79-09994

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 7: COMBINED SEWER OVERFLOW REGULATION,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5F.
W79-09999

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 8: URBAN STORMWATER MANAGEMENT,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10000

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 803, Price codes: A12 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 256 p, 6 fig, 28 tab, 7 append.

Descriptors: *Massachusetts, *Waste water treatment, *Sewers, *Interceptor sewers, *Model studies, *Waste water management, *Treatment facilities, *Pumping stations, *Headworks, Conveyance structures, Engineering structures, Hydraulic structures, Cost analysis, Simulation, Analytical techniques, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. The purpose of this volume is to inventory and evaluate the MDC interceptors, pumping stations and headworks in terms of their adequacy to meet projected needs under various concepts and the recommended plan, and to recommend the general upgrading required at the pumping stations and headworks. The existing system is described and the evaluation procedure outlined. For each of four proposed service area concepts, sewer relief requirements are presented and compared in terms of cost and priorities. The wastewater pumping stations and headworks are analyzed and improvements suggested by looking at capacity requirements. Each of the 10 main pumping stations is analyzed separately and estimated rehabilitation or replacement costs presented, ranging from $203,000 to rehabilitate the Houghs Neck station to $6,000,000 to replace the Charlestown station. The interceptor system was evaluated through computer modeling of the MDC sewers in order to determine their hydraulic adequacy to transport projected flows. A series of appendices presents interceptor data and modeling packages; modeling results are discussed. Inventories of the pumping stations and headworks are included. (See also W79-09992) (Zayac-NC)
W79-10001

A STUDY OF THE PERMANENT EFFECTS OF ELEVATED TEMPERATURE ON THE HYDRAULIC PROPERTIES OF CLAY,
Auburn Univ., AL. Dept. of Civil Engineering.
D. R. Cullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 686, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, August 1979, 74 p, 20 fig, 18 tab. OWRT A-069-ALA(1).

Descriptors: Kaolinite, Illite, Bentonite, Temperature, *Clays, *Hydraulic conductivity.

The constant rate of strain consolidometer was employed in the study of the permanent effects of elevated temperature on the hydraulic properties of Georgia kaolinite, Urbana illite, and bentonite. Samples consolidated from a slurry were heat treated at temperatures of 20, 90, and 160 degrees C for twelve hours and tested using the constant rate of strain consolidation technique at 20 degrees C to measure hydraulic conductivity, volume compressibility and the coefficient of consolidation. The one-way analysis of variance (fixed effects model) was employed to test for significant linear and quadratic temperature effects. The level of statistical significance was determined for each test. Urbana illite demonstrated a significant quadratic temperature effect in terms of hydraulic conductivity, which was maximized by the 90 degree C treatment. The bentonite clay sample was found to have significant temperature effects associated with hydraulic conductivity and volume compressibility. These effects were linear and positive. Georgia kaolinite did not display significant changes in hydraulic properties caused by temperature.
W79-10022

8C. Hydraulic Machinery

POWER PRODUCTION AT FEDERAL DAMS COULD BE INCREASED BY MODERNIZING TURBINES AND GENERATORS.

General Accounting Office, Washington, DC. Energy and Minerals Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 254, Price codes: A02 in paper copy, A01 in microfiche. Report EMD-77-22, March 16, 1977. 15 p, 1 append.

Descriptors: *Dams, *Hydroelectric power, *Efficiencies, Electric power, Electric power production, Hydroelectric plants, Equipment, Electrical equipment, Electrical generators, Turbines, Hydraulic turbines, Turbine runners, Energy, Modernizing.

Existing Federal hydroelectric plants could increase power production by modernizing turbines to increase efficiencies and capacities and by modernizing generators to increase capacities. Increasing hydroelectric power production: (1) will increase the Nation's energy supply, (2) will displace consumption of nonrenewable fuels by fossil-fueled power plants, (3) will reduce pollution, (4) will increase Federal revenues, and (5) will displace or delay construction of alternate power sources. Federal agencies that operate hydroelectric plants should evaluate existing plants to identify and act on these opportunities. (Sims-ISWS)
W79-09991

8D. Soil Mechanics

ENGINEERING PROBLEMS ASSOCIATED WITH EXPANSIVE CLAYS FROM ROMANIA,
Institutul de Constructii din Bucuresti (Romania). Dept. of Soil Mechanics and Foundation Engineering.
For primary bibliographic entry see Field 2G.
W79-09972

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER ANALYSIS IN SOUTH AFRICA: INTERLABORATORY COMPARISON STUDIES, PART IV: MINERAL ANALYSIS,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Water S.A., Vol. 5, No. 2, p 61-69, April 1979. 8 fig, 4 tab, 13 ref.

Descriptors: *Water analysis, *Laboratory tests, Water chemistry, Sodium, Potassium, Calcium, Magnesium, Chlorides, Sulfates, Fluorides, Alkalinity, Laboratory equipment, Volumetric analysis, Flame photometry, Cations, South Africa.

Sixteen South African water analysis laboratories performed mineral analyses on samples of known concentrations for sodium, potassium, calcium, magnesium, chloride, sulphate, fluoride, and total alkalinity. Each laboratory was supplied with six 250cc samples, allowed to use any analytical method desired, and allowed one month to return their results. Each laboratory was allocated a code number, known only to that laboratory and the originator of the study. Nine of the participants determined sodium by the flame photometric technique, while seven used atomic absorption. For potassium, ten laboratories used flame photometry and six atomic absorption. For both, atomic absorption results had a slightly better degree of precision. For calcium and magnesium, nine laboratories used atomic absorption, while seven employed titration methods. Again, atomic absorption results were more accurate. Comparisons between automated and manual methods of analysis for chloride and sulphate showed no significant differences in precision or accuracy. Fluoride results showed good accuracy and precision with analysis by ion-selective electrode being the most popular method. Potentiometric titration gave more accurate results than other methods for total alkalinity. Overall, only about 7% of the results could be regarded as unacceptable according to Greenberg's assessment method. Study results compared favorably with those from similar overseas studies. (Seigler-IPA)
W79-09841

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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 24
DECEMBER 15, 1979

W79-10081 --W79-10330

Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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ABSTRACT SOURCES

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

COMMENT ON 'GOVERNING EQUATIONS FOR GEOTHERMAL RESERVOIRS' BY D. H. BROWNELL, S. K. GARG, AND J. W. PRITCHETT,
Geological Survey, Sacramento, CA. Water Resources Div.
D. C. Helm.
Water Resources Research, Vol. 15, No. 3, p 723-726, June 1979. 6 ref.

Descriptors: *Hydrogeology, *Geothermal studies, *Reservoirs, *Mathematical studies, *Equations, Thermal water, Physical properties, Porosity, Continuity equation, Energy, Mass, Momentum equation, Evaluation, *Governing equations.

In their 1977 paper published in Water Resources Research, D. H. Brownell, S. K. Garg, and J. S. Pritchett developed a series of balance equations for mass, momentum, and energy. (See W78-02542). The mass balance equations (for both solid and liquid phases), as developed in their paper, require an element of interest to be fixed in space. The momentum and energy balance equations for the solid phase, as developed in their paper, require an element of interest to be fixed in the solid phase. The momentum and energy equations for the liquid phase, as developed in their paper, require an element of interest to be fixed in the liquid phase. The authors are asked to comment on the apparent ambiguity of their assuming that the entire series of balance equations can be applied to a single element of interest, rather than to the three distinct elements that are inherent in their development. The conceptual problem is illustrated by reference to the porosity term in their equations. (Woodard-USGS)
W79-10160

GEOTHERMAL RESERVOIR SIMULATION: 3. APPLICATION OF LIQUID- AND VAPOR-DOMINATED HYDROTHERMAL MODELING TECHNIQUES TO WAIRAKEI, NEW ZEALAND,
Geological Survey, Reston, VA. Water Resources Div.
J. W. Mercer, and C. R. Faust.
Water Resources Research, Vol. 15, No. 3, p 653-671, June 1979. 26 fig, 1 tab, 20 ref.

Descriptors: *Geothermal studies, *Model studies, *Simulation analysis, *Thermal properties, *Hydrothermal studies, Aquifer characteristics, Groundwater movement, Steady flow, Unsteady flow, Leakage, Heat flow, Confined water, Correlation analysis, Evaluation, *New Zealand.

A quasi three-dimensional areal model, based on finite-difference approximations, was applied to the hydrothermal field at Wairakei, New Zealand. The model simulates heat transport associated with the flow of steam and water through porous media. An analysis was made of the production aquifer under steady-state and transient flow conditions, allowing vertical flow of heat and fluid through confining beds. Computed steady-state results correlate well with observed data and indicate that portions of the aquifer had a steam cap prior to exploitation. Computed transient results also match observed data and support the hypothesis that the production aquifer is recharged through underlying confining beds. The limiting factor on production is the amount of mass available, both from storage and leakage. Although simulation results indicate that the field can maintain production rates to the year 2000, such long range predictions are unreliable due to the lack of information on the leakage properties of the confining beds. (See also W79-06303 and W79-06304) (Woodard-USGS)
W79-10162

FLUID SAMPLE COLLECTION AND DISTRIBUTION SYSTEM,
National Aeronautics and Space Administration, Washington, DC. (Assignee).
R. L. Brooks.
U.S. Patent No. 4,151,086, 9 p, 2 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1390-1391, April 24, 1979.

Descriptors: *Patents, *Water treatment, *Sampling, Water quality control, Filtering, Analytical techniques, Water analysis, Automatic control, Equipment, Backwash, Sensors.

A method and apparatus is provided for automatically collecting aqueous samples from any one of a number of sampling points along a process flow path. The samples are continuously presented to various chemical and biological analyzing sensors in various stages of filtration. The system may be sequenced around the performance of sensor analyzers to permit backwash and cleaning of sample flow filters without interupting the analyzing sequence. (Sinha-OEIS)
W79-10167

1B. Aqueous Solutions and Suspensions

THE EFFECT OF NITRIFICATION ON THE OXYGEN BALANCE OF THE UPPER CHATTAHOOCHEE RIVER, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
T. A. Ehlke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 347, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-10, 1978. 13 p, 4 fig, 4 tab, 14 ref.

Descriptors: *Nitrification, *Biochemical oxygen demand, *Bacteria, *Rivers, Reaeration, Dissolved oxygen, Water analysis, Ammonium compounds, Nitrites, Nitrates, Nitrogen, Bottom sediments, Georgia, *Upper Chattahoochee River basin, *Nitrosomonas, *Nitrobacter.

Oxygen consumption as a result of nitrification, and carbonaceous bacterial oxidation were compared in a 108 kilometer reach of the Chattahoochee River, Georgia. Nitrogenous and carbonaceous oxygen consumption were separated by using an inhibitor of nitrification 1-allyl-2-thiourea. The comparison was conducted in the laboratory using samples collected from the water column. Nitrification accounted for 38 to 52 percent of the total oxygen consumption. Nitrifying bacteria were enumerated from the same reach of the river. The population of Nitrosomonas ranged from 10 to 1,000 per milliliter in the water column and 100 to 100,000 per gram of benthic sediment. The nitrobacter population ranged from 10 to 100 per milliliter in the water column and 100 to 1,000 per gram in the benthic sediment. The concentration of ammonium, nitrite, and nitrate as N was determined from water samples collected throughout the study reach. The average rate of ammonium disappearance and of nitrate appearance was 0.02 milligram per liter per hour of flow time. (Woodard-USGS)
W79-10170

CARBON DIOXIDE IN THE OCEAN SURFACE: THE HOMOGENEOUS BUFFER FACTOR,
Geological Survey, Reston, VA. Water Resources Div.; and University of East Anglia, Norwich (England). Climatic Research Unit.
E. T. Sundquist, L. N. Plummer, and T. M. L. Wigley.
Science, Vol. 204, p 1203-1205, June 1979. 1 fig, 1 tab, 15 ref.

Descriptors: *Carbon dioxide, *Oceans, *Chemical reactions, Atmosphere, Evaluation, *Ocean surface, Buffer, Marine chemistry, Homogeneous reactions, Chemical oceanography.

The amount of CO_2 which can be dissolved in surface sea water depends at least partially upon the homogeneous buffer factor, which is a mathematical function of the chemical equilibrium conditions among the various dissolved inorganic species. Because these equilibria are well known, the homogeneous buffer factor is well known. Natural spatial variations depend very systematically upon sea surface temperatures, and do not contribute significantly to uncertainties in the present or future CO_2 budget. (Woodard-USGS)
W79-10176

2. WATER CYCLE

2A. General

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME I, FEBRUARY 28-MARCH 3, 1977.
Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, 1977. 470 p. Correll, D. L., Editor. NSF ENV 74-24271 A03, ENV 76-22045.

Descriptors: *Watersheds(Basins), *Hydrology, *Model studies, *North America, *Conferences, Demonstration watersheds, Agricultural watersheds, Research and development, Land use, Precipitation(Atmospheric), Nutrients, Groundwater, Water balance, Water quality, Drainage, Ecosystems, Sediment discharge, Publications, Nutrient discharge, Particulate discharge.

The workshop provided for the exchange of research results, discussion of its significance in better management of drainage basins and in conducting further research on their hydrological characteristics. To better manage drainage basins requires more understanding of the quantitative and qualitative properties of drainage basins, complete characterization of their ecosystems, and application of those understandings towards solutions to problems of environmental quality. Volume I of the proceedings included papers presented in the following areas: (1) overviews of watershed programs; (2) chemical loading of the watershed; (3) hydrology; (4) nutrient discharge; and (5) particulate discharge. Each paper was followed by discussion. A list of attendees was included. (See also W79-02571, W79-02573, W79-02574 and W79-10085 thru W79-10107) (Humphreys-ISWS)
W79-10084

LAKE JACKSON WATERSHED STUDY: DESCRIPTION OF SITES, METHODOLOGY AND SCOPE OF RESEARCH,
Oak Ridge National Lab., TN.
R. R. Turner, T. M. Burton, and R. C. Harriss.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 19-33, 1977. 3 fig, 1 tab, 16 ref.

Descriptors: *Watersheds(Basins), *Water quality, *Runoff, *Urbanization, *Florida, Urban runoff, Forest watersheds, Forests, Agriculture, Cities, Storm runoff, Lakes, Rainfall, Pollutants, Suspended solids, Dissolved solids, Chloride, Silicon, Nutrients, Chemicals, Sampling, Land use, *Lake Jackson(FL).

The Lake Jackson watershed study was undertaken to quantify changes in water quality and geochemical exports resulting from urbanization within the 11,900 hectare watershed of a recreational lake in north Florida. Three subbasins of 430, 611, and 792 hectares in size and otherwise similar in all respects except land-use were instrumented for intensive hydrologic and chemical monitoring during a two-year period (June 1973-May 1976). Two of these subbasins offered considerable contrast in major land use: (1) rapidly developing urban, versus (2) stable forested-agricultural. The third was intermediate between these extremes of land use. The streams draining the subbasins were gradually intermittent with respect to flow, and thus major emphasis was placed on characterizing storm events. Hydrologic records for each water sampling station were provided through a cooperative arrangement with the Geological Survey. Water samples were collected both man-

ually and by automatic discrete samplers. Constituents measured included suspended solids, dissolved solids, chloride, dissolved silicon, and dissolved nutrients (nitrogen and phosphorus). The data obtained in this study are being used to identify and explore the hydrochemical consequences of urbanization on a small drainage basin scale. (See also W79-10084) (Sims-ISWS)
W79-10087

THE MAHANTANGO CREEK WATERSHED--AN INTERDISCIPLINARY WATERSHED RESEARCH PROGRAM IN PENNSYLVANIA,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
H. B. Pionke, and R. N. Weaver.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 83-103, 1977. 6 fig, 33 ref.

Descriptors: *Watersheds(Basins), *Research and development, *Northeast US, Rainfall, Precipitation(Atmospheric), Runoff, Hydrology, Water quality, Land use, Planning, Mining, Erosion, Geology, Soils, Infiltration, Evapotranspiration, On-site investigations, *Mahantango Creek Watershed(PA).

The objectives of this paper were to describe the scope of the watershed research program and the physical characteristics of the watershed and to present sufficient information upon which subsequent papers of this series can build to achieve their objectives. The paper was organized into 4 parts. The first 3 treat separately the watershed research programs of the Agricultural Research Service (ARS), the Northeast Watershed Research Center (NWRC), and the Mahantango Creek Watershed. Because the Mahantango Creek Watershed is a component of these 2 larger watershed research programs, the research role of the watershed must be considered in the context of the encompassing programs. The watershed was physically described in this third part. The fourth part identified, referenced, and briefly describe past research accomplishments. (See also W79-10084) (Sims-ISWS)
W79-10090

AN OVERVIEW OF THE RHODE RIVER WATERSHED PROGRAM,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. L. Correll.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 105-123, 1977. 1 fig, 1 tab, 15 ref. EPA R804536-01.

Descriptors: *Watersheds(Basins), *Instrumentation, *Land use, *Maryland, Water quality, Pollutants, Pollutant identification, Rain gages, Stream gages, Weirs, Sampling, Forests, Agriculture, Nutrients, Cations, Herbicides, Bacteria, Rivers, Estuaries, *Rhode River Watershed(MD).

This research program is a long-term effort to better understand specifically the functioning of a 3,332 ha eastern coastal plain drainage basin on Maryland's western shore of Chesapeake Bay. More generally, it is an effort to relate discharge characteristics to land use and to assess the transfer value of the results within the coastal plain. The major land use categories on the area are forest and old fields, pasture, row crops, residential, upland wet areas, and tidal marshes. Research was initiated in 1971 on 5 basins. Permanent weirs with automatic volume-integrating composite samplers were constructed, beginning in 1973. At the end of 1976, 11 permanent and 2 portable stations were in operation, 3 permanent stations were under construction, and 3 more permanent stations were planned and funded. Precipitation chemistry and a network of rain gauges were initiated in 1973. Runoff waters were analyzed for suspended particulate, nutrient, cation, herbicide, and bacterial parameters. In the case of small, 'single-use' watersheds, the plant cover and soil characteristics were also intensively studied. The land use of the whole area was studied by analysis of aerial photos and by door-to-door interviewing of land owners. Data gathered in the program was stored on magnetic tape. A conclusion from the analysis of the data was that land use is the most important factor in causing water quality differences in runoff from Rhode River sub-watersheds at any one time. (See also W79-10084) (Sims-ISWS)
W79-10091

HYDROLOGIC CHARACTERISTICS OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
G. S. Henderson, D. D. Huff, and T. Grizzard.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 195-210, 1977. 5 fig, 3 tab, 14 ref.

Descriptors: *Watersheds(Basins), *Demonstration watersheds, *Hydrology, *Tennessee, Research facilities, Instrumentation, Stream gages, Weirs, Rain gages, Rainfall, Precipitation(Atmospheric), Runoff, Streamflow, Evaporation, Evapotranspiration, Water balance, Discharge(Water), Groundwater, Recharge, Natural recharge, Forests, Forest watersheds, *Walker Branch Watershed(TN).

Walker Branch Watershed, a 97.5 ha deciduous forest catchment on dolomitic terrain, received annual precipitation averaging 151.1 cm over a six-year period from 1970-1976. Approximately 57% of this precipitation left the watershed as streamflow. Soil evaporation and canopy interception with subsequent evaporation loss were well represented by relationships derived for eastern hardwoods and amounted to about 12% of precipitation. Transpiration accounted for the remainder (31%) of the water loss from the watershed. Seasonal precipitation-streamflow balances showed that precipitation is relatively uniformly distributed throughout the year, while streamflow varies seasonally with high flows from December through May and low flows from June through November. Baseflow discharge patterns from the two subcatchments are different, the smaller basin yielding relatively more than the larger one. This difference is thought to be due to groundwater exchange between the two through channels in the dolomitic bedrock. The hydrologic data base is used extensively in nutrient and trace element cycling studies and in development of mechanistic hydrologic models. (See also W79-10084) (Sims-ISWS)
W79-10095

DESCRIPTIVE HYDROLOGY OF THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Oak Ridge National Lab., TN.
R. R. Turner, T. M. Burton, and R. C. Harriss.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 211-226, 1977. 2 fig, 2 tab, 20 ref.

Descriptors: *Watersheds(Basins), *Urbanization, *Land use, *Florida, Urban runoff, Forest watersheds, Agricultural watersheds, Streamflow, Storm runoff, Hydrographs, Drainage, Rainfall, Precipitation(Atmospheric), Evaporation, Hydrology, Urban hydrology.

Results of hydrologic studies on 3 adjacent watersheds in north Florida representing, respectively, urban (792 ha), suburban (430 ha), and forested-agricultural (611 ha) land uses support theory and the findings of others that urbanization (1) increases storm peak flows, (2) increases the ratio of quickflow volume to delayed flow volume, and (3) increases annual runoff. Total runoff losses from the forested-agricultural, suburban, and urban basins during the period July 1973 to June 1975 were, respectively, 31.2, 38.1, and 48.3 cm of which 39%, 51%, and 82% were quickflow. Ratios of total quickflow volume to total precipitation over the study period were 0.05, 0.08, and 0.16 for the forested-agricultural, suburban, and urban watersheds, respectively. Comparison of individual storm hydrographs also revealed striking contrasts in the relative magnitude and temporal distribution of streamflow from these watersheds. Maximum discharges during the study period were 0.19 cu m/sec/sq km (forested-agricultural), 0.75 cu m/sec/sq km (suburban), and 2.37 cu m/sec/sq km (urban). When combined with results of contemporaneous water quality studies on the same watersheds, these hydrologic findings offer an ideal example of some hydrochemical consequences of urbanization on a small watershed scale. (See also W79-10084) (Sims-ISWS)
W79-10096

THE MAHANTANGO CREEK WATERSHED--GENERAL HYDROLOGY AND RESEARCH RESULTS,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
W. J. Gburek.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 227-250, 1977. 8 fig, 6 tab, 32 ref.

Descriptors: *Watersheds(Basins), *Networks, *Research facilities, *Hydrology, Precipitation(Atmospheric), Rainfall, Runoff, Streamflow, Water quality, Soil moisture, Groundwater, Spatial distribution, Temporal distribution, Instrumentation, Rain gages, Stream gages, Storms, Hydrological data, *Mahantango Creek Watershed(PA).

The experimental watersheds of the Agricultural Research Service (ARS), USDA, have traditionally been a major source of continuous, long-term, small watershed hydrologic data for the scientific community. Data from these watersheds, representing varied physiographic provinces of the U.S., have been used extensively by university researchers, private consultants and planners, and other governmental research and planning agencies The Mahantango Creek Watershed in east-central Pennsylvania was chosen as the Northeast Watershed Research Center (NWRC) research watershed. One reason for this choice was that continuous flow records had been collected since 1930 at a U.S. Geological Survey streamgage at the watershed outlet. The NWRC installed an instrumentation network over its entirety to collect routine rainfall-runoff data. The purposes of this network were: to characterize general magnitudes and variabilities associated with the watershed's rainfall-runoff processes; to develop a limited data base upon which to test future concepts developed; and to indicate any unexpected abnormalities within the watershed's hydrologic cycle. The instrumentation of the network was described, and some research results were reported. (See also W79-10084) (Sims-ISWS)
W79-10097

THE MAHANTANGO CREEK WATERSHED--EVALUATING THE SHALLOW GROUNDWATER REGIME,
Science and Education Administration, University Park, PA Northeast Watershed Research Center
For primary bibliographic entry see Field 2F
W79-10098

OBSERVATIONS ON THE WATER BALANCE FOR SEVEN SUB-BASINS OF RHODE RIVER, MARYLAND,
Smithsonian Institution, Edgewater, MD Chesapeake Bay Center for Environmental Studies
G. R. Chirlin, and R. W. Schaffner
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 277-306, 1977 8 fig, 9 tab, 36 ref EPA

R804536-01.

Descriptors: *Water balance, *Rainfall, *Runoff, *Evaporation, *Maryland, Watersheds(Basins), Rain gages, Stream gages, Streamflow, Precipitation(Atmospheric), Sampling, Streams, Rivers, Evapotranspiration, Storage, Rainfall-runoff relationships, Meteorology, Hydrology, *Rhode River Watershed(MD).

The precipitation and streamflow gauging and sampling facilities on the Rhode River, Maryland, watershed were described. Seven sub-basins were examined over the three calendar year period 1974-75-76 for basin characteristics and precipitation, runoff, and their difference ('net input'). Average annual rainfall for the period was 119 cm at a central gauge. Sub-basins range in size from 28.2 ha to 253.7 ha and in annual discharge from 67,700 to 913,000 cu m/yr. The weir of sub-basin 108 suffers significant submergence at high flows, as confirmed by its uniquely high flows per unit area at those times. Deep losses from the watersheds seem unlikely in view of the very low conductivity of an underlying clay formation (the Marlboro Clay) and the close inter-basin agreement in yearly runoff depths. However, the true thickness and extent of the clay have not been surveyed. Interception, gross storage, and transpiration were crudely estimated for sub-basin 101, the respective percentages being 11%, 22%, and 42% of annual precipitation. (See also W79-10084) (Sims-ISWS)
W79-10099

NUTRIENT EXPORT FROM THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5B.
W79-10101

PATTERNS OF ORGANIC MATTER TRANSPORT ON WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
C. E. Comiskey, G. S. Henderson, R. H. Gardner, and F. W. Woods.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 439-469, 1977. 8 fig, 5 tab, 35 ref.

Descriptors: *Organic matter, *Streams, *Watersheds(Basins), Vegetation, Leaves, Rainfall, Runoff, Precipitation(Atmospheric), Streamflow, Detritus, Nutrients, Streambeds, Biology, Hydrology, Hydraulics, *Walker Branch Watershed(TN).

Aspects of a study of organic material transport in a headwater stream system were discussed. Transfer of large (greater than 1 mm) particulate allochthonous organic leaf material to the heterotrophically based aquatic system occurred primarily as direct leaf fall and blow-in. Factors determining allochthonous inputs and residence time in the stream system involved the interaction of phenological, geomorphic, and meteorological phenomena. Leaf fall inputs followed the normal temperate deciduous cycle with maximum inputs occurring in the autumn during litterfall. Quantification of blow-in included three variables: aspect, percent slope, and month. Results showed an initial peak during litterfall and a large peak during the mid-winter to mid-spring period. The steepest, southwest-facing slopes generally contributed the highest inputs. Standing crops of large (greater than 1 mm) particulate organic leaf material on 4 stream habitat types (dry gravel, stream flow gravel, dry bedrock, and bedrock pools) showed significant differences (alpha = 0.05) for both date and habitat type, reflecting the influences of the hydrologic cycle and within-system biological processing on the allochthonous inputs. The temporal sequence of allochthonous organic inputs to the stream system serves as a source of replenishment of the aquatic food base which might otherwise be severely depleted during periods of high stream discharge. (See also W79-10084) (Sims-ISWS)
W79-10106

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME II, FEBRUARY 28-MARCH 3, 1977.
Report No. NSF/RA-770255. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, 1977. 455 p. Correll, D.L., Editor. NSF ENV 74-24271 A03, ENV 76-22045.

Descriptors: *Watersheds(Basins), *Model studies, *North America, *Conferences, *Water pollution, Agricultural watersheds, Land use, Ecosystems, Demonstration watersheds, Organic matter, Toxins, Suspended load, Suspended solids, Nutrients, Water pollution sources, Water quality, Coliforms, Microorganisms, Oligotrophy, Sediment transport, Research and development, Trace elements, Herbicides, Water sampling, Microorganism discharge, Toxic materials discharge, Particulate discharge.

The workshop provided for the exchange of research results and for discussion of its significance in better management of drainage basins and in conducting further research on hydrological characteristics of drainage basins. Better management of drainage basins requires more understanding of the quantitative and qualitative properties of drainage basins, complete characterization of their ecosystems, and application of those understandings towards solutions to problems of environmental quality. Volume II of the proceedings included papers presented in the following areas: (1) particulate discharge; (2) microorganism discharge; (3) toxic materials discharge; and (4) watershed modeling. Each paper was followed by discussion. (See also W79-02572, W79-10084, and W79-10108 thru W79-10126) (Humphreys-ISWS)
W79-10107

SUSPENDED AND DISSOLVED SOLIDS EXPORTS FROM THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 2J.
W79-10108

LARGE PARTICULATE ORGANIC MATTER PROCESSING IN STREAM ECOSYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. R. Webster.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 505-526, 1977. 5 fig, 6 tab, 38 ref. NSF GB-43255, NSF AG-199, BMS 76-00761.

Descriptors: *Demonstration watersheds, *Forest watersheds, *North Carolina, *Water pollution sources, Organic matter, Streams, Watersheds(Basins), Ecosystems, Litter, Leaves, Vegetation, Trees, Deciduous forests, On-site investigations, Mountain forests, Leaf litterfall.

The stream ecosystems of eastern deciduous forests are highly adapted to their riparian terrestrial surroundings. Particulate organic matter inputs from the riparian vegetation are processed by the combined action of microbes and invertebrates and the mechanical action of flowing water. In unperturbed Coweeta streams, processing efficiency is 95-99%. Processing efficiency is less in watersheds where the vegetation has been disturbed. Comparison of Coweeta data with other studies suggested a greater processing efficiency in southeastern than northeastern streams. (See also W79-10107) (Humphreys-ISWS)
W79-10109

DISCHARGE OF SUSPENDED PARTICULATES FROM RHODE RIVER SUBWATERSHEDS,
Smithsonian Institution, Washington, DC. Div. of Sedimentology.
For primary bibliographic entry see Field 2J.
W79-10110

THE APPLICATION OF ANALYTIC AND MECHANISTIC HYDROLOGIC MODELS TO THE STUDY OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
D. D. Huff, G. S. Henderson, C. L. Begovich, R. J. Luxmoore, and J. R. Jones.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 741-766, 1977. 12 fig, 2 tab, 27 ref.

Descriptors: *Watersheds(Basins), *On-site investigations, *Model studies, Streamflow, Runoff, Base flow, Storm runoff, Groundwater, Groundwater movement, Evaporation, Evapotranspiration, Rainfall, Precipitation(Atmospheric), Storage, Soil water, Hydrology, *Walker Branch Watershed(TN).

Hydrologic studies at Walker Branch Watershed combine field data collection, use of analytic methods for data processing, and the use of models to explore hypotheses that result from analysis. For example, examination of delayed flow from the two sub-basins of Walker Branch showed a quantitative exchange from one sub-basin to the other. The data also suggested a relationship between delayed flow rate and fraction of delayed flow volume exchanged. Simulation results supported the analysis but raised additional questions for further field study and data analysis. A similar approach to studies of quick-flow and evapotranspiration leads to a suggestion that storm runoff in uniform for both sub-basins and is related to the moisture content of surface soils, as influenced by evapotranspiration. (See also W79-10107) (Sims-ISWS)
W79-10120

SAMPLING METHODOLOGIES FOR ASSESSING RURAL RUNOFF,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
F. J. Humenik, F. Koehler, L. Bliven, J. W. Gilliam, and M. R. Overcash.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 791-808, 1977. 1 fig, 8 tab, 8 ref. EPA R803328.

Descriptors: *Runoff, *Sampling, *Rural areas, *Water quality, Streamflow, Sediment transport, Chemicals, Pollutants, Nitrogen, Phosphates, Nitrates, Chlorides, Carbon, Chemical oxygen demand, Sediments, Rainfall, Base flow, Analytical techniques, Methodology, Hydrology.

Sample methodologies for obtaining information to describe small rural streams were evaluated. Two types of sampling, grab and automated, were utilized in the present study. Estimates from both types of sampling were presented, and the implications of the differences in data retrieved were discussed. Instrumentation and associated hardware for automated sampling sites were detailed, and the rationale utilized in the design of the automated sampling program was explained. The suite of parameters measured was described, and the relative importance of each parameter as an indicator of water quality was discussed. The concept of an essential set of parameters was introduced, and some tentative conclusions were proffered. The use of climatological data to estimate the total number of field trips necessary to satisfy data base requirements within a project time span was described. Many researchers have investigated methods for estimating annual sediments yields from relatively few data points using the flow-duration sediment-transport method. The feasibility of this concept to calculate the average annual

transport of total nitrogen and total phosphate was investigated. The usefulness and limitations of this method were discussed. (See also W79-10107) (Sims-ISWS)
W79-10121

PROBABILITY SAMPLING OF SMALL STREAMS: PROBLEMS AND RESULTS,
North Carolina State Univ. at Raleigh. Inst. of Statistics.
For primary bibliographic entry see Field 7B.
W79-10122

A LINEAR APPROACH TO THE CALCULATION OF AREA YIELD COEFFICIENTS BASED ON LAND USE,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bihliographic entry see Field 5B
W79-10123

APPLICATIONS OF A MARYLAND VERSION OF USDAHL-74 TO A WATERSHED IN PRINCE GEORGE'S COUNTY, MARYLAND,
Maryland Univ., College Park.
H. N. Holtan, J. P. Ormsby, and G. T. Fisher.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255, Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 887-908, 1977. 4 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Watersheds(Basins), *Maryland, *Runoff, *Water quality, *Model studies, Mathematical models, Computer models, Soils, Infiltration, Discharge(Water), Storage, Precipitation(Atmospheric), Rainfall, Land use, Remote sensing, Satellites(Artificial), Agriculture, Forests, Pollutants, Chemicals, Water chemistry, Analytical techniques, *Patuxent River(MD), *Prince George's County(MD), USDAHL model.

Prospective users of the USDAHL Model of Watershed Hydrology often think that inputs to the model are extremely difficult to obtain. This treatise was designed to illustrate some of the sources and labors required for inputs and to provide some measurements of the prognostication possibilities with this model. The example used was the Western Branch of the Patuxent River in Prince George's County, Maryland, above USGS streamgage No. 1594500 near Largo. This area was chosen because it has undergone considerable change in land use and urban development during the last decade. Also, the USGS has published a record of attending streamflow from this basin suitable for evaluating model outputs. Zoning is the first decision in applying USDAHL. For the single purpose of computing outflow from the watershed, zoning would be by soil types, by topography, or by land use, whichever varies the most drastically. The zone approach offers many possibilities in hydrology for chemical accounting. It permits isolation of a single feature of land use into a zone by itself. Combined with LANDSAT remote sensing of watershed features, USDAHL offers an expeditious means of deriving comprehensive estimates and greater vision of watershed hydrology as affected by land use and treatment. (See also W79-10107) (Sims-ISWS)
W79-10125

HYDROLOGIC DATA SOURCES,
Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.
For primary bibliographic entry see Field 7C.
W79-10126

A METHOD OF ESTIMATING PARAMETERS AND ASSESSING RELIABILITY FOR MODELS OF STEADY STATE GROUNDWATER FLOW 2. APPLICATION OF STATISTICAL ANALYSIS,
Geological Survey, Denver, CO. Water Resources Div.
R. L. Cooley.
Water Resources Research, Vol. 15, No. 3, p 603-617, June 1979. 10 fig, 6 tab, 22 ref.

Descriptors: *Groundwater movement, *Model studies, *Analytical techniques, *Aquifer characteristics, *Hydrogeology, Mathematical models, Physical properties, Permeability, Transmissivity, Groundwater recharge, Evaluation, Parameter estimation, Inverse problem.

Techniques of nonlinear regression were applied to estimate the hydrogeologic parameters (values of transmissivity or hydraulic conductivity), recharge, discharge, and boundary fluxes for steady-state ground-water flow models of two field areas: a cross-section in the Hula Basin, Israel, and in Truckee Meadows, Nevada. Statistical techniques were used to estimate the degree of nonlinearity of the models, goodness of fit of the models to field data, and reliability of predictions to be made with the models. Analysis of goodness of fit included estimation of reliability and significance of computed parameters and reliability of the computed head distribution. Both cases analyzed behaved at least approximately linearly based on Beale's measure of nonlinearity; that variable reliability of observed head data had to be incorporated into the analysis for Truckee Meadows; that residuals, transformed to eliminate heteroskedasticity and intercorrelation, may be independently normally distributed in the case of Truckee Meadows (testing was not carried out for Hula Basin because of possible lack of model fit); and that standard errors for parameters for both cases were large, indicating nonuniqueness of the solution, even though model fit was good for Truckee Meadows and was fair for Hula Basin. Reliability of the predicted drawdown distribution and pumping rate was estimated for a gravel-pit operation in Truckee Meadows. In spite of the nonuniqueness problem, predictions of these quantities were not significantly different at a level of significance of 0.05 from the observed values. (See also W77-10008) (Woodard-USGS)
W79-10161

HYDROLOGIC EVALUATION OF THE ALTON RECLAMATION-STUDY SITE, ALTON COAL FIELD, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. W. Sandberg
Geological Survey open-file report 79-346, 1979. 53 p, 5 fig, 8 tab, 7 ref.

Descriptors: *Baseline studies, *Water quality, *Groundwater, *Surface waters, *Land reclamation, Data collections, Hydrogeology, Streamflow, Sediment transport, Observation wells, Potentiometric level, Water levels, Irrigation wells, Aquifers, Test wells, Transmissivity, Evaluation, *Alton coal field(UT), Pre-strip mining.

An investigation was conducted from July 1974 to September 1977 to define general hydrologic conditions at a reclamation-study site in the Alton coal field near Kanah, Utah. The average annual streamflow through the area was less than 600 acre-feet, and the water carried little sediment except during floods which result from intense local storms. Most of the surface water seeps into the ground or is diverted for irrigation downstream from the study area. Ground-water data were insufficient to define the potentiometric surface in most of the area. The water level in each of the three observation wells is above the coal layer in the immediate area of the well. A larger network of wells is needed to define the potentiometric surface throughout the area and to show its relation to surface water and the location of the coal layers. Hydrologic data should be collected continuously to establish a hydrologic base before mining begins, and data collection should be continued through the periods of mining and reclamation. (Woodard-USGS)
W79-10166

EFFECTS OF PUMPING ON GROUNDWATER LEVELS NEAR TAYLORSVILLE, BATHOLOMEW COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
M. Planert, and P. Tucci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 244, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-20, February 1979. 22 p, 12 fig, 7 ref.

Descriptors: *Model studies, *Drawdown, *Pumping, *Aquifer systems, *Water levels, Indiana, Groundwater movement, Hydrogeology, Observation wells, Hydrographs, Evaluation, *Continuous pumping, *Well field, *Bartholomew County(Ind).

A two-dimensional digital flow model was used to estimate the effects of continuous pumping of a public-supply well field on the ground-water levels near Taylorsville, Indiana. Results of the modeling showed that the water levels would decline from less than 1 to about 4.5 feet within the study area and a maximum of 1 to 2 feet in Taylorsville in response to a pumping rate of 700 gallons per minute. Model results also show that the groundwater system would reach steady state in approximately 5 years after pumping begins. Corrections applied to water-level declines indicated by the model, to account for the effects of partial penetration of the aquifer by wells, showed that these effects, although substantial in the pumping wells, are negligible 200 feet from the wells. (Woodard-USGS)
W79-10169

NOTE ON THE APPLICATION OF CLASSICAL EXTREME VALUE THEORY TO FLOOD DATA,
Otago Univ. (New Zealand). Dept. of Geography.
W. E. Bardsley.
Journal of Hydrology, Vol. 42, No. 1/2, p 195-198, June 1979. 10 ref.

Descriptors: *Annual flood, *Mathematical models, *Stochastic processes, Statistical methods, Analytical techniques, Floods, Hydrology, Watersheds(Basins), Distribution, Extreme value theory.

Todorovic and Zelenhasic and others have advocated the use of exact distributions of order statistics from random sample size to describe flood maxima from fixed time intervals. It was suggested in this paper that the asymptotic extreme value distributions are not necessarily inappropriate in this situation and possess some useful advantages over the exact distributions. (See also W71-03680 and W71-04590) (Humphreys-ISWS)
W79-10262

AREAL INTERPOLATION OF RAINFALL WITH A DOUBLE FOURIER SERIES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2B.
W79-10266

COLLINEARITY AND STABILITY IN THE ESTIMATION OF RAINFALL-RUNOFF MODEL PARAMETERS,
Iowa Univ., Iowa City. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-10268

2B. Precipitation

WALKER BRANCH WATERSHED ELEMENT CYCLING STUDIES: COLLECTION AND ANALYSIS OF WETFALL FOR TRACE ELEMENTS AND SULFATE,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2K.
W79-10092

PRECIPITATION AND NUTRIENT EXPORT FROM A SMALL COASTAL ECOSYSTEM IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology

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For primary bibliographic entry see Field 2K.
W79-10093

HYDROLOGIC CHARACTERISTICS OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10095

DESCRIPTIVE HYDROLOGY OF THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10096

THE MAHANTANGO CREEK WATERSHED--GENERAL HYDROLOGY AND RESEARCH RESULTS,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2A.
W79-10097

OBSERVATIONS ON THE WATER BALANCE FOR SEVEN SUB-BASINS OF RHODE RIVER, MARYLAND,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A.
W79-10099

THE APPLICATION OF ANALYTIC AND MECHANISTIC HYDROLOGIC MODELS TO THE STUDY OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10120

HYDROLOGIC DATA SOURCES,
Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.
For primary bibliographic entry see Field 7C.
W79-10126

OBSERVATIONS OF THE MORPHOLOGY OF MELTING SNOW,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 2C.
W79-10243

HURRICANE SURGE POTENTIALS OVER SOUTHEAST LOUISIANA AS REVEALED BY A STORM-SURGE FORECAST MODEL: A PRELIMINARY STUDY,
National Weather Service, New Orleans, LA.
For primary bibliographic entry see Field 2L.
W79-10254

A HYDROLOGIC REANALYSIS OF THE LA PORTE ANOMALY,
Boston Univ., MA. Dept. of Geography.
R. R. Clark.
Bulletin of the American Meteorological Society, Vol. 60, No. 5, p 415-421, May 1979. 2 fig, 3 tab, 13 ref.

Descriptors: *Rainfall, *Distribution patterns, *Streamflow, *Indiana, Meteorological data, Hydrologic data, Data processing, Analytical techniques, Precipitation(Atmospheric), Discharge(Water), Rivers, River flow, Meteorology, Climatology, Hydrology, *La Porte(IN), *La Porte anomaly.

The 1929-64 precipitation record at La Porte was analyzed through the use of a budgetary hydrologic model. Pre- and postanomaly data allowed accurate estimation of stream discharge for the La Porte region, but use of the anomaly period data caused consistent significant overestimation of discharge. If both the La Porte data and the stream discharge data are accurate, then La Porte can only be a small-scale phenomenon, affecting a small portion of the basin. The post-1960 disappearance of the anomaly could be explained by the movement of a local anomaly, dissipation of the anomaly mechanism by a reduction of atmospheric particulates, or elimination of gage and/or observer error. Of the three, gage and/or observer error appears most likely to be the cause of the anomaly. (Sims-ISWS)
W79-10255

AREAL INTERPOLATION OF RAINFALL WITH A DOUBLE FOURIER SERIES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
W. R. Thorpe, C. W. Rose, and R. W. Simpson.
Journal of Hydrology, Vol. 42, No. 1/2, p 171-177, June 1979. 2 fig, 1 tab, 7 ref.

Descriptors: *Rainfall disposition, *Mathematical models, *Australia, *Watersheds(Basins), Rainfall, Areal, Fourier analysis, Isohyets, Analytical techniques, Algorithms, Spatial distribution, Distribution patterns, Double Fourier method.

The double Fourier method described was shown to provide a more accurate estimate of catchment rainfall than the Thiessen method when applied to a particular, analytically defined rainfall distribution. The procedure also overcomes the objection of Edwards to a previous method of James in that dense raingauge networks are not usually required since it provides an objective method of fitting surfaces to less than 9 data points. (See also W75-04693) (Humphreys-ISWS)
W79-10266

2C. Snow, Ice, and Frost

OBSERVATIONS OF THE MORPHOLOGY OF MELTING SNOW,
National Center for Atmospheric Research, Boulder, CO.
C. A. Knight.
Journal of the Atmospheric Sciences, Vol. 36, No. 6, p 1123-1130, June 1979. 7 fig, 17 ref.

Descriptors: *Snow, *Melting, *Cloud physics, Data collections, Sampling, On-site investigations, Laboratory tests, Photography, Crystals, Snowfall, Precipitation(Atmospheric), Meteorology, Snow morphology.

The forms of snow crystals and flakes in various stages of melting can be observed with substantial fidelity after collecting the particles in subfreezing hexane. These forms are largely determined by minimum surface area considerations, which can lead to the breakup of some forms. The collection method might be useful in detailed studies of the radar bright band. (Sims-ISWS)
W79-10243

2D. Evaporation and Transpiration

OBSERVATIONS ON THE WATER BALANCE FOR SEVEN SUB-BASINS OF RHODE RIVER, MARYLAND,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A.
W79-10099

A SOIL-PLANT-ATMOSPHERE MODEL FOR TRANSPIRATION AND AVAILABILITY OF SOIL WATER,
Northeastern Forest Experiment Station, Durham, NH.
C. A. Federer.
Water Resources Research, Vol. 15, No. 3, p 555-562, June 1979. 3 fig, 2 tab, 27 ref

Descriptors: *Transpiration, *Soil water, *Model studies, Soil types, Soils, Soil-water-plant relationships, Internal water, Hardwood, Stomata, *Soil water potentials, Vapor flux, Stomatal response, Internal resistance, Hardwood forest, Potential gradient, Soil water content, Plant behavior.

In a soil-plant-atmosphere model, the soil was divided into several layers with different root densities and soil water potentials, but the aboveground portion was represented by single values both of diffusive resistance and of plant water potential. The model used Cowan's theory for root uptake, Monteith's combination equation for vapor flux, constant internal resistance per unit of root length, and stomatal response to light, humidity, temperature, and plant water potential. For forests, unstressed transpiration, defined as the transpiration that would occur if stomatal opening were not reduced by low plant water potential, may be a more useful value than potential evapotranspiration. The model simulated field data from a hardwood forest in terms of both plant water potential and stomatal behavior within a day and over a summer. Stomata had a threshold type of response to plant water potential, with closure occurring as plant water potential approached a critical potential. Internal resistance was high enough that when unstressed transpiration was high, plant water potential became low enough to cause some stomatal closure and reduce transpiration even when soil was wet. (Roberts-ISWS)
W79-10247

ESTIMATION OF THE ISOTOPIC COMPOSITION OF LAKE EVAPORATE,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.
For primary bibliographic entry see Field 7C.
W79-10267

2E. Streamflow and Runoff

DRAINAGE BASIN RESEARCH IN EASTERN NORTH AMERICA,
National Science Foundation, Washington, DC. Div. of Advanced Environmental Research and Technology.
E. H. Bryan.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 1-3, 1977.

Descriptors: *Watersheds(Basins), *Chesapeake Bay, *Conferences, *Research and development, *Northeast US, Drainage, Water quality, Water pollution, Water pollution sources, Environment, Research priorities.

This introductory address reviewed the drainage basin research in the eastern United States supported by the National Science Foundation and by the Environmental Protection Agency. Research of the Chesapeake Bay drainage basins was emphasized. The need for workshops and conferences was described. (See also W79-10084) (Sims-ISWS)
W79-10085

LAKE JACKSON WATERSHED STUDY: DESCRIPTION OF SITES, METHODOLOGY AND SCOPE OF RESEARCH,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10087

AN OVERVIEW OF THE CHOWAN RIVER RURAL RUNOFF STUDY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W79-10088

WATERSHED RESEARCH IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-10089

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THE MAHANTANGO CREEK WATERSHED--AN INTERDISCIPLINARY WATERSHED RESEARCH PROGRAM IN PENNSYLVANIA,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2A.
W79-10090

AN OVERVIEW OF THE RHODE RIVER WATERSHED PROGRAM,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A.
W79-10091

HYDROLOGIC CHARACTERISTICS OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10095

DESCRIPTIVE HYDROLOGY OF THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10096

OBSERVATIONS ON THE WATER BALANCE FOR SEVEN SUB-BASINS OF RHODE RIVER, MARYLAND,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A.
W79-10099

NUTRIENT DISCHARGE FROM RHODE RIVER WATERSHEDS AND THEIR RELATIONSHIP TO LAND USE PATTERNS,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10105

PATTERNS OF ORGANIC MATTER TRANSPORT ON WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10106

DYNAMICS OF TRACE ELEMENT EXPORT FROM A DECIDUOUS WATERSHED, WALKER BRANCH, TENNESSEE,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-10116

LAND UTILIZATION AND METALS DISCHARGE FROM THE RHODE RIVER WATERSHED,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10117

THE APPLICATION OF ANALYTIC AND MECHANISTIC HYDROLOGIC MODELS TO THE STUDY OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10120

PROBABILITY SAMPLING OF SMALL STREAMS: PROBLEMS AND RESULTS,
North Carolina State Univ. at Raleigh. Inst. of Statistics.
For primary bibliographic entry see Field 7B.
W79-10122

HYDROLOGIC DATA SOURCES,
Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.
For primary bibliographic entry see Field 7C.
W79-10126

LOW-FLOW CHARACTERISTICS OF ALABAMA STREAMS,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
R. H. Bingham.
Alabama Geological Survey Division of Water Resources Bulletin 117, 1979. 39 p, 9 fig, 1 plate, 10 ref.

Descriptors: *Low flow, *Base flow, *Alabama, *Streams, *Natural flow, Estimating, Flow rates, Analytical techniques, Regression analysis, Flow characteristics, Hydrologic data, Surface-groundwater relationships, Aquifer characteristics, Groundwater movement, Hydrogeology.

A new procedure for estimating the 7-day 2-year and the 7-day 10-year low flow of ungaged Alabama streams is based on geology, drainage area, and mean annual precipitation. One equation for each of the two low-flow frequencies applies statewide to all natural flow streams; the equations do not apply to streams where flow is significantly altered by activities of man. The standard error of estimate of each equation based on map values is 40 percent for 7-day 2-year, and 44 percent for 7-day 10-year low flow. Examples of using the new estimating procedures are given. The rate of streamflow recession is used to account for the effects of geology on low flow. Streamflow recession rate depends primarily on transmissivity and storage characteristics of the aquifers, and average distance from stream channels to divides. Relations of low-flow discharge to geology, drainage area, and mean annual precipitation were analyzed by multiple regression techniques. Data used in the regressions are included. (Woodard-USGS)
W79-10181

QUANTITATIVE DESCRIPTION OF DEPRESSION STORAGE USING A DIGITAL SURFACE MODEL, I. DETERMINATION OF DEPRESSION STORAGE,
Guelph Univ. (Ontario). School of Engineering.
W. Ullah, and W. T. Dickinson.
Journal of Hydrology, Vol. 42, No. 1/2, p 63-75, June 1979. 4 fig, 1 tab, 20 ref.

Descriptors: *Depression storage, *Topography, *Photogrammetry, *Computer programs, *Data processing, Storage capacity, Numerical analysis, Surface drainage, Surfaces, Topology, Digital data, Tilled land.

Depression storage is a dominating storage element which accounts for most of the retention on a watershed surface. Because of practical difficulties in making direct measurement of the dimensions of individual depressions, the values of depression storage have either been assumed or indirectly estimated. The physical properties of a surface in terms of depression storage depend upon the surface configuration which can be modelled with a set of elevation values given as a function of horizontal coordinates. These values constitute a digital surface model. A photogrammetric technique has been used to develop digital surface models for 15 sample plots, of about 160 cm x 200 cm size, having similar physiographic conditions. A simple digital technique was developed and used to determine the geometric properties of individual depressions of all sample plots. The method scans the digital surface model and identifies characteristic points of depressions such as low points, pour points, etc. The information obtained in the process was used to compute the geometric properties of depressions, depth, surface area, and volume. (See also W79-10239) (Adams-ISWS)
W79-10238

QUANTITATIVE DESCRIPTION OF DEPRESSION STORAGE USING A DIGITAL SURFACE MODEL, II. CHARACTERISTICS OF SURFACE DEPRESSIONS,
Guelph Univ. (Ontario). School of Engineering.
W. Ullah, and W. T. Dickinson.
Journal of Hydrology, Vol. 42, No. 1/2, p 77-90, June 1979. 8 fig, 2 tab, 6 ref.

Descriptors: *Depression storage, *Topography, *Statistical methods, *Regression analysis, Correlation analysis, Geomorphology, Hydrology, Equations, Surface drainage, *Weibull distribution.

Results of analysis of data of volume, depth, and surface area of individual depressions were presented. The spatial distribution of depressions was found to be both random and direction oriented. Depression storage volume decreases with the slope of the plot due to a reduction in both the number of depressions and the dimensions of individual depressions. The three geometric properties depth, surface area, and volume are also related to each other. The geometric properties of the depressions exhibit a frequency distribution of somewhat similar characteristicity. The observed frequency distribution can be satisfactorily described by the Weibull distribution. (See also W79-10238) (Adams-ISWS)
W79-10239

HURRICANE SURGE POTENTIALS OVER SOUTHEAST LOUISIANA AS REVEALED BY A STORM-SURGE FORECAST MODEL: A PRELIMINARY STUDY,
National Weather Service, New Orleans, LA.
For primary bibliographic entry see Field 2L.
W79-10254

A HYDROLOGIC REANALYSIS OF THE LA PORTE ANOMALY,
Boston Univ., MA. Dept. of Geography.
For primary bibliographic entry see Field 2B.
W79-10255

THE EXTREME-VALUE TYPE-I DISTRIBUTION AND THE PRINCIPLE OF MAXIMUM ENTROPY,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
P. W. Jowitt.
Journal of Hydrology, Vol. 42, No. 1/2, p 23-38, June 1979. 1 tab, 13 ref.

Descriptors: *Floods, *Theoretical analysis, *Mathematical models, *Mathematical studies, Stochastic processes, Annual flood, Statistical methods, Hydrology, Distribution, Probability, Mathematics, Algorithms, Extreme values, Annual maximum floods.

The properties and problems in parameter estimation of the extreme-value type 1 (EV1) distribution were discussed and then further examined using the principle of maximum entropy. This emerging concept points to a unique technique for the parameter estimation and provides the necessary justification for Kimball's method over maximum likelihood. The maximum likelihood estimators were shown to be equivalent for large sample sizes only. A simple algorithm for this parameter estimation technique was presented and illustrated using an historical record of annual maximum floods. The algorithm provided rapid convergence when applied to an actual set of annual maximum flood statistics. (Humphreys-ISWS)
W79-10263

LIMITED CONFIDENCE IN CONFIDENCE LIMITS DERIVED BY OPERATIONAL STOCHASTIC HYDROLOGIC MODELS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
V. Klemes, and A. Bulu.
Journal of Hydrology, Vol. 42, No. 1/2, p 9-22, June 1979. 5 fig, 4 tab, 17 ref.

Descriptors: *Hydrologic data, *Statistical methods, *Streamflow, *Time series analysis, *Hydrologic properties, Correlation analysis, Stochastic processes, Hydrology, Probability, Model studies, Probability density functions, Annual flow series, Statistical parameters.

A split-sample experiment involving the derivation of confidence limits for various statistical param-

eters by 3 different operational stochastic models fitted to a 25-year segment of a 100 year long series of mean monthly flows and a subsequent comparison of these limits with the parameters for the 3 remaining 25-year segments of the historic series led to the conclusion that only limited confidence in the confidence limits of hydrologic models is warranted. (Adams-ISWS)
W79-10264

APPLICATION OF THE AUTORUN TEST TO HYDROLOGIC DATA,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Z. Sen.
Journal of Hydrology, Vol. 42, No. 1/2, p 1-7, June 1979. 2 fig, 1 tab, 6 ref.

Descriptors: *Persistence, *Hydrologic properties, *Statistical methods, *Time series analysis, Hydrology, Statistics, Rivers, Equations, Correlation analysis, Probability, Streamflow, On-site tests, Autorun test, Independent series, Dependent series.

The statistical test referred to as the autorun test was described. This test was used to determine whether a data series is independent or dependent. The test was applied to annual series of 8 rivers with records from 34 to 150 years long. One illustration of the application of the test on a monthly flow series also was given. (Adams-ISWS)
W79-10265

COLLINEARITY AND STABILITY IN THE ESTIMATION OF RAINFALL-RUNOFF MODEL PARAMETERS,
Iowa Univ., Iowa City. Dept. of Civil Engineering.
P. K. Kitanidis, and R. L. Bras.
Journal of Hydrology, Vol. 42, No. 1/2, p 91-108, June 1979. 4 fig, 6 tab, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Runoff, Equations, Parametric hydrology, Stability, Statistical models, Statistical methods, Hydrology, Rivers, Algorithms, Flow, Filters, Parameter estimation, Collinearity, Kalman filter.

The common use of statistical rainfall-runoff models of the regressive type leads to the problem of handling the unavoidable correlation existing between the explanatory variables of these models. The above collinearity problem was treated using ridge regression techniques. This powerful regression method was extensively presented and discussed. Examples showed that collinearity has significant effects on values of rainfall-runoff model parameters and that ridge regression effectively deals with the problem, leading to well-behaved model coefficients. The important issue of parameter stability was also addressed using both ridge regression and Kalman filtering as estimation procedures. It was shown that considerable data are required before parameter stability is achieved, casting serious doubts on the predictive capability of models developed with usually limited historical data. Although a powerful methodology, Kalman filtering exhibited disturbing instability and lack of convergence unless special algorithms of high numerical accuracy were used. (Lee-ISWS)
W79-10268

2F. Groundwater

THE MAHANTANGO CREEK WATERSHED--EVALUATING THE SHALLOW GROUNDWATER REGIME,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
J. B. Urban.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 251-276, 1977. 10 fig, 14 ref.

Descriptors: *Watersheds(Basins), *Groundwater, *Hydrogeology, Geology, Stratigraphy, Instrumentation, Water levels, Water level fluctuations, Groundwater movement, Recharge, Specific capacity, Transmissivity, Travel time, Wells, Water wells, Pumping, Drawdown, Precipitation(Atmospheric), Rainfall, Hydrology, *Mahantango Creek Watershed(PA).

The groundwater in the Mahantango Creek Watershed exists as a layered system of perched and regional groundwater. The perched groundwater is in a zone of rock fracturing ranging from 1 to 10 meters deep. The perched groundwater merges with fragipan soil water and the regional groundwater near the prominent small streams. Groundwater levels respond to precipitation from within minutes to hours. Most groundwater recharge occurs during the dormant season, but occasional wet periods during the summer can result in small recharge events. Water level trends indicate that the groundwater is in a steady-state condition in terms of years but not seasonally. Groundwater divides occur at topographic divides; no watershed losses are likely in the Mahantango Creek portion of the watershed. Pumping of the groundwater wells in the area, both research wells and homeowner wells, indicates that wells in sandstone or siltstone in the bottom-land areas of the watershed are the highest yielding. Specific capacity is used as an index to rate the water yield potential of wells in various topographic settings and rock types. Specific capacities are converted to transmissivity or permeability, and potential groundwater velocities are calculated which indicate that groundwater velocities can be expected to range from 0.003 meter per day or less to 0.9 meter per day at unit gradient and from 0.0003 to 0.09 at field water table gradients. (See also W79-10084) (Sims-ISWS)
W79-10098

THE APPLICATION OF ANALYTIC AND MECHANISTIC HYDROLOGIC MODELS TO THE STUDY OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10120

COMMENT ON 'GOVERNING EQUATIONS FOR GEOTHERMAL RESERVOIRS' BY D. H. BROWNELL, S. K. GARG, AND J. W. PRITCHETT,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 1A.
W79-10160

A METHOD OF ESTIMATING PARAMETERS AND ASSESSING RELIABILITY FOR MODELS OF STEADY STATE GROUNDWATER FLOW 2. APPLICATION OF STATISTICAL ANALYSIS,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-10161

EFFECTS OF PUMPING ON GROUNDWATER LEVELS NEAR TAYLORSVILLE, BATHOLOMEW COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-10169

GROUND WATER RESOURCES OF GEORGIA,
Georgia Univ., Athens. Inst. of Government.
J. E. Kundell.
1978. 139 p, 15 fig, 6 tab, 20 ref, 1 append.

Descriptors: *Groundwater resources, *Aquifers, *Legislation, *Georgia, Groundwater availability, Hydrologic cycle, Sand aquifers, Topography, Water quality, Legal aspects, Artesian aquifers, Aquifer characteristics, Water yield, Water rights, Regulation, Water pollution, Water pollution sources, Coastal plains, Groundwater movement.

This report was designed to provide a base of information on the groundwater resources of Georgia and to point out current problems. Major aquifers described included shallow sand and recent deposits, principal artesian, Claiborne, Clayton, Cretaceous, Piedmont, Blue Ridge, and Northwest Georgia. Limited data were presented for each aquifer. Although the Geological Survey has been able to model the groundwater resource in the Savannah and Brunswick areas, the nature of the resource in much of the rest of the state is still not sufficiently understood. Therefore, research is needed to provide the facts upon which decisions can be based. Problem areas identified in this study included: (1) Savannah and Chatham County, (2) Brunswick and Glynn County, (3) Southwest Georgia, (4) The Gulf trough, (5) The Valdosta area, and (6) Northwest Georgia. Activities of the courts in dealing with groundwater issues are nearly nonexistent. A number of laws relating to both surface and groundwater use were discussed. Major acts impacting upon water include the following: (1) The Georgia Water Quality Control Act of 1964, (2) The Underground Gas Storage Act of 1965, (3) The Ground Water Use Act of 1972, (4) The Oil and Gas and Deep Drilling Act of 1975, (5) The Water Well Standards Act of 1976, (6) The Georgia Safe Drinking Water Act of 1977, and (7) The Water Conservation Plumbing Act of 1977. Copies of these laws were included in the Appendix. Two state agencies hold primary responsibility for groundwater use. The Geologic and Water Resources Division of the Department of Natural Resources works closely with the Geological Survey in researching the groundwater system of Georgia. The Environmental Protection Division of the Department of Natural Resources is the regulatory agency charged with protecting the water resources. Activities of these agencies were discussed. (Humphreys-ISWS)
W79-10241

THE USE OF A GAMMA LOGGER TO DELINEATE GLACIAL AND BEDROCK STRATIGRAPHY IN SOUTHWESTERN OHIO,
Miami Univ., Oxford, OH. Dept. of Geology.
A. D. Baldwin, Jr., and J. Miller.
Ground Water, Vol. 17, No. 4, p 385-389, July-August 1979. 5 fig, 3 ref.

Descriptors: *Gamma rays, *Glaciology, *Glacial sediments, *Ohio, Glacial drift, Glacial aquifers, Bedrock, Till, Sands, Stratigraphy, *Gamma logger, *Glacial stratigraphy, Bedrock stratigraphy, Gamma ray logger, Uplands, Glacial outwash aquifer, Till sheets, Cincinnatian series.

An evaluation was made of the usefulness of the gamma-ray logger in delineating glacial-drift and bedrock stratigraphy in southwestern Ohio. The logger was useful in delineating gross stratigraphic units in the glacial outwash aquifer. The gamma log also provided a clearer indication of the clay content of sand and gravel units than did the driller's log. On the uplands, away from the valleys filled with glacial outwash, the logger could not be used to locate the thin, poorly-sorted, interstadial sand and gravel deposits between thicker till sheets. However, it could be used to distinguish formational contacts in the upper Cincinnatian Series. (Roberts-ISWS)
W79-10246

2G. Water In Soils

SOIL WATER AND CHEMICAL MOVEMENT IN A SLOPING FRAGIPAN SYSTEM,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
W. R. Heald, and A. S. Rogowski.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 385-399, 1977. 9 fig, 1 tab, 7 ref.

Descriptors: *Soil water movement, *Chemicals, *Path of pollutants, Soil water, Chemical analysis, Nitrates, Chlorides, Magnesium, Potassium,

Sodium, Electrical conductance, Moisture content, Water table, Evapotranspiration, Wells, Water wells, Instrumentation, Sampling, On-site investigations, Model studies, *Mahantango Creek(PA).

Researchers studying problems involving water flow in the field generally hope that water contents and gradients measured in situ will agree with the theoretical predictions. However, as the size of the study area and the complexity of flow increase, numerous simplifying assumptions are usually required. Frequently, additional information may be available that is not fully utilized. This study attempted to show how such information, in this case results based on chemical analysis of soil water samples, can be used to complement hydrologic findings. (See also W79-10084) (Sims-ISWS)
W79-10103

COMPARISON OF THREE FIELD METHODS FOR DETERMINING SATURATED HYDRAULIC CONDUCTIVITY,
South Dakota State Univ., Brookings. Dept. of Agricultural Engineering.
D. W. DeBoer.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 569-572, May-June 1979. 2 fig, 2 tab, 19 ref.

Descriptors: *Hydraulic conductivity, *Saturated flow, *Soil water, Irrigation, On-site investigations, Drainage, Porosity, Soil water movement, Water table, Analytical techniques, Methodology, Soils, Agriculture.

Pump-in, auger hole, and drain line methods were used to estimate the saturated hydraulic conductivity of a 1.0 ha experimental area. The pump-in value was about 1/2 the auger hole value. A composite pump-in value for the layered soil profile was about equal to the drain line value. (Sims-ISWS)
W79-10250

NEMATICIDE DISTRIBUTION UNDER A DRIP EMITTER,
Georgia Cooperative Extension Service, Attapulgus.
P. M. Garvey, J. L. Chesness, and U. E. Brady.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 546-548, May-June 1979. 3 fig, 1 tab, 17 ref.

Descriptors: *Nematocides, *Infiltration, *Distribution patterns, Peaches, Pesticides, Nematodes, Soils, Soil water, Soil water movement, Irrigation, Spatial distribution, Wetting, Agriculture, On-site investigations, Drip emitters.

Distribution of nematicide in the soil when applied at different concentrations through a drip irrigation emitter was studied. Concentrations of 30, 800, and 1500 ppm were used, and soil volumes exposed to lethal concentrations of the nematicide were determined for each. (Sims-ISWS)
W79-10251

2H. Lakes

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME I, FEBRUARY 28-MARCH 3, 1977.
For primary bibliographic entry see Field 2A.
W79-10084

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME II, FEBRUARY 28-MARCH 3, 1977.
For primary bibliographic entry see Field 2A.
W79-10107

BEHAVIOR OF MAJOR SOLUTES DURING CLOSED-BASIN BRINE EVOLUTION,
Johns Hopkins Univ. Baltimore, MD. Dept. of Earth and Planetary Sciences; and Geological Survey, Reston, VA. Water Resources Div.
H. P. Eugster, and B. F. Jones.
American Journal of Science, Vol. 279, p 609-631, June 1979. 25 fig, 1 tab, 50 ref.

Descriptors: *Water chemistry, *Solutes, *Lake basins, *Chemical reactions, Sorption, Physical properties, Chemical properties, Sediments, Salinity, Evaluation, *Closed basins.

The pronounced chemical fractionation which takes place in hydrologically closed basins between dilute inflow and concentrated brines can be accounted for by a variety of mechanisms. These include mineral precipitation, selective dissolution of efflorescent crusts and sediment coatings, surface sorption on active surfaces, degassing, and redox reactions. Major solutes are differentially affected by these mechanisms and their response may differ from basin to basin. Using data from Lake Magadi, Kenya; Lake Abert, Oregon; Devils Lake, North Dakota; Deep Springs Lake, California; Basque Lake, British Columbia; and Great Salt Lake, Utah; some of these differences can be delineated. In most of these systems, chloride behaves as a conservative element and can be used to monitor the progress of evaporative concentration; (Ca + Mg) are removed from solution principally by mineral precipitation, commonly involving carbonate minerals. Carbonate species are depleted through mineral precipitation, degassing, and selective dissolution of efflorescent crusts. The fractionation between Na and K is pronounced in the inflow waters of all but one of the closed basins, with Na being enriched over K in solution up to 100-fold. Surface sorption and bacterial reduction appear to be the principal processes for sulfate fractionation from closed basin saline waters. In more concentrated brines, sulfate often accumulates until saturation with respect to sodium sulfate minerals is reached. (Woodard-USGS)
W79-10172

2I. Water In Plants

A REVIEW OF THE BIOLOGY, ECOLOGY, AND MANAGEMENT OF SCIRPUS OLNEYI: VOLUME II: A SYNTHESIS OF SELECTED REFERENCES,
Maryland Dept. of Natural Resources, Annapolis. Wetlands Permit Div.
W. S. Sipple.
Wetland Publication No. 4, September 6, 1979. 85 p.

Descriptors: *Bulrushes, *Ecology, Management, Distribution, Genetics, Reproduction, Soils, Succession, Growth and development, Physical and biological impacts, Morphology, Physiology, Taxonomy, Ontogeny.

This synthesis of selected references on Scirpus olneyi incorporates information from most of references cited in Volume I (An Annotated Bibliography of Selected References) as well as information from additional references. A total of 185 references are cited. There are sections on biology, ecology, and management. The biology section includes information on geographical distribution, taxonomy, genetics, anatomy, morphology, reproduction, and growth and development. The ecology section includes information on general habitat, vegetation types and structure, successional relationships, physical and chemical factors affecting plant growth and development, soils, and standing crop of biomass. The management section includes information on artificial plant establishment, seed collection, seed handling and storage, control of plant competition, physical impacts, biological impacts, and importance to wildlife. (See also W79-02110)
W79-10185

2J. Erosion and Sedimentation

THE MAHANTANGO CREEK WATERSHED--SOURCE AND REACTION OF PHOSPHATE DURING STORM HYDROGRAPHS.
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
W79-10104

SUSPENDED AND DISSOLVED SOLIDS EXPORTS FROM THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, R. R. Turner, and R. C. Harriss.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 471-485, 1977. 1 fig, 6 tab, 10 ref.

Descriptors: *Watersheds(Basins), *Florida, *Demonstration watersheds, *Sediment transport, Suspended solids, Land use, Agricultural watersheds, Dissolved solids, On-site data collections, On-site investigations, Water sampling, Analysis, Particle size, Organic matter, Sediment discharge, Water quality, Urban watersheds, Volatile solids.

Exports of suspended (SS), volatile suspended (VSS), dissolved (DS), and volatile dissolved (VDS) solids from three north Florida watersheds were monitored from 1973 to 1975. The forested-agricultural watershed exported 40 kg/ha/yr SS, 11 kg/ha/yr VSS, 71 kg/ha/yr DS, and 29 kg/ha/yr VDS. There was a 126-fold increase in sediment exports from the urban watershed, a 28-fold increase in VSS exports, a 6-fold increase in DS, and a 4-fold increase in VDS compared to the forested-agricultural watershed. The low density suburban watershed exported intermediate amounts of all solids, but these increases were attributable primarily to highway construction within the watershed and are not typical of highly forested, low residential areas. The dramatically increased sediment losses resulted in large increases in total and particulate phosphorus exports. Corrective measures to minimize losses from the urban watershed have been undertaken and were discussed briefly. (See also W79-10107) (Humphreys-ISWS)
W79-10108

DISCHARGE OF SUSPENDED PARTICULATES FROM RHODE RIVER SUBWATERSHEDS,
Smithsonian Institution, Washington, DC. Div. of Sedimentology.
J. W. Pierce, and F. T. Dulong.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 531-553, 1977. 7 fig, 5 tab, 32 ref. EPA R804536-01, SRF 460126.

Descriptors: *Sediment discharge, *Watersheds(Basins), *Chesapeake Bay, *Maryland, Streams, On-site investigations, Suspended solids, Erosion rates, Sampling, Discharge(Water), Measurement, Streamflow, Rainfall, Data collections, *Rhode River(MD), Solids concentration.

Discharge of total particulate material, as well as the mineral and organic phases constituting the total, from a portion of the watershed into the Rhode River has been monitored for 3 years. There were 5 monitored streams at the end of 1974 and 11 at the end of 1976. Composited, flow-integrated samples were acquired weekly from each weir. Concentrations of solids ranged over 3 orders of magnitude. Discharge of solids past the different weirs ranged from a low of 7.5 metric tons to over 115 metric tons per year. On a unit area basis the annual discharge ranged from 45 kg/ha to over 511 kg/ha. Erosion rates ranged from 0.45 cm/1000 years to slightly over 5 cm/1000 years. Little change was noted in the mineralogy of the suspended particles except for an increase in quartz and feldspar during periods of high water discharge. Monitoring of one storm event on two streams indicated that spot samples give poor estimates of discharge. Over 97% of the weekly discharge occurred during 24 hours of storm runoff; 92% in 12 hours. The weekly flow-integrated concentration and average flow rate occurred during

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40 minutes and 65 minutes, respectively, of the entire week but did not occur at the same time. Coring of the sediment deposit in the basin behind one weir suggested that channel storage is relatively insignificant on small streams over the long term. As much as 9 times the volume of possible stored material was discharged past the weir over a period of 1.5 years. (See also W79-10107) (Humphreys-ISWS)
W79-10110

MODELING SEDIMENT TRANSPORT IN NATURAL CHANNELS,
Hydrocomp, Inc., Palo Alto, CA.
R. C. Johanson, and K. M. Leytham.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 861-885, 1977. 5 fig, 24 ref.

Descriptors: *Sediment transport, *Channels, *Pollutants, *Model studies, Mathematical models, Sediments, Clays, Silts, Soils, Sands, Organic matter, Colloids, Scour, Deposition(Sediments), Chemicals, Water quality.

This article discussed some of the problems which must be addressed when modeling the transport of sediment from the perspective of pollutant studies. The role played by colloidal material in conveying pollutants was stressed. A sediment transport model being developed by Hydrocomp, Incorporated, for the Environmental Protection Agency was outlined. The concepts and constructs which were used to represent the behavior of mixtures of cohesionless and cohesive sediments were presented. Some questions were posed which must be answered if significant progress is to be made in this field. (See also W79-10107) (Sims-ISWS)
W79-10124

RELATION OF SEDIMENT YIELD TO CLIMATIC AND PHYSICAL CHARACTERISTICS IN THE MISSOURI RIVER BASIN,
Geological Survey, Lawrence, KS. Water Resources Div.
P. R. Jordan.
Geological Survey Water-Resources Investigations 79-49, March 1979. 26 p, 1 fig, 7 tab, 22 ref.

Descriptors: *Sediment transport, *Streamflow, *Sediment yield, *Reservoir silting, *Missouri River, Basins, Hydrologic data, Sediment load, Forecasting, Regression analysis, Evaluation.

Data from 64 stream-sediment stations and reservoirs in the plains area and from 15 stream-sediment stations in the mountainous area of the Missouri River basin were analyzed to determine the relation of sediment yield to basin characteristics. Data from each sediment station and reservoir represented at least 7 years of sediment discharge in the plains area or 4 years of sediment discharge in the mountainous area. Results of the analysis show the approximate relations of sediment yield to basin characteristics in the plains area, but data for the mountainous area are insufficient to show any significant relation. In the plains area the sediment yield was most closely related to contributing drainage area, mean streamflow, average thickness of loess, and average land slope. A regression equation, using these characteristics, estimates sediment yields with a standard error of +142 percent and -59 percent. The relation of sediment yield to size of drainage area was consistent with the relation found earlier for the upper Mississippi River basin. (Woodard-USGS)
W79-10179

FILTRATION OF SEDIMENT BY SIMULATED VEGETATION I. STEADY-STATE FLOW WITH HOMOGENEOUS SEDIMENT,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W79-10252

2K. Chemical Processes

WALKER BRANCH WATERSHED ELEMENT CYCLING STUDIES: COLLECTION AND ANALYSIS OF WETFALL FOR TRACE ELEMENTS AND SULFATE,
Oak Ridge National Lab., TN.
S. E. Lindberg, R. R. Turner, N. M. Ferguson, and D. Matt.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 125-151, 1977. 2 fig, 9 tab, 40 ref.

Descriptors: *Rainfall, *Chemistry of precipitation, *Chemical analysis, *Trace elements, *Tennessee, Precipitation(Atmospheric), Chemistry, Sampling, Data collections, Equipment, Instrumentation, Analytical techniques, Cadmium, Manganese, Lead, Zinc, Sulfur, Chemicals, Pollutants, Water pollution, Air pollution, Watersheds(Basins), *Walker Branch Watershed(TN).

A precipitation sampling network designed specifically to optimize sample collection and handling for trace analysis has been established at Walker Branch Watershed, Tennessee, to accurately quantify the atmospheric input of trace elements. The network consists of 6 rain activated wetfall collectors of the AEC-HASL design which have been modified with respect to construction materials and arrangement of components in order to minimize trace element contamination. Wetfall has been collected through a combination of event and continuous sampling at 4 throughfall, 1 ground level incident, and 1 above canopy incident precipitation sites. Trace metal analyses were performed by graphite furnace atomic absorption spectroscopy without preconcentration to reduce the chance of contamination. Sulfate-S was determined by a modified methylthymol blue technique. Preliminary data for water year 1975-76 yielded weighted mean concentrations (and coefficients of variation) for Cd, Mn, Pb, Zn, and SO4-S in incident precipitation as 0.89 (108%), 1.5 (97%), 5.5 (54%), 7.1 (111%), and 840 (48%) micrograms/liter, respectively. For storm events, spatial effects on incident and throughfall rain chemistry were significant. Temporal effects on chemistry were also significant at some incident and throughfall sites. In comparison with published trace element concentrations in rain, the levels at WBW were closer to those measured at rural and remote forested locations than those observed near industrial or urban centers. (See also W79-10084) (Sims-ISWS)
W79-10092

PRECIPITATION AND NUTRIENT EXPORT FROM A SMALL COASTAL ECOSYSTEM IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
W. C. Hart, and J. G. Ogden, III.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 153-167, 1977. 1 fig, 3 tab, 17 ref.

Descriptors: *Chemistry of precipitation, *Rainfall, *Chemicals, *Canada, Ions, Nutrients, Sampling, Chemical analysis, Data processing, Nitrogen, Sodium, Phosphorus, Calcium, Chlorine, Potassium, Pollutants, Air pollution, Water pollution, Path of pollutants, *Nova Scotia.

Ionic budgets for a bog-pond complex near Halifax, Nova Scotia, were compared with ionic inputs via atmospheric precipitation. Based on three years of atmospheric precipitation sampling and lake water surface collected 15 years apart, it appears that the chemistry of regional precipitation in Nova Scotia had not changed between 1957 and 1974. (See also W79-10084) (Sims-ISWS)
W79-10093

NUTRIENT LOADING OF THE RHODE RIVER WATERSHED VIA LAND USE PRACTICE AND PRECIPITATION,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10094

NUTRIENT DISCHARGE FROM WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-10100

NUTRIENT EXPORT FROM THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5B.
W79-10101

NUTRIENT YIELD ASSESSMENT BY DIFFERENT SAMPLING STRATEGIES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-10102

SOIL WATER AND CHEMICAL MOVEMENT IN A SLOPING FRAGIPAN SYSTEM,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2G.
W79-10103

GEOCHEMISTRY OF GROUND WATER ASSOCIATED WITH TUFFACEOUS ROCKS, OASIS VALLEY, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
A. F. White.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.50. Geological Survey Professional Paper 712-E, 1979. 25 p, 13 fig, 7 tab, 40 ref.

Descriptors: Geochemistry, *Chemical reactions, *Hydrogeology, *Water chemistry, *Groundwater movement, Observation wells, Rhyolites, Evapotranspiration, Chemistry of precipitation, Kinetics, Radioactive dating, Fluorides, Model studies, *Volcanic glass, *Tuffaceous rocks, *Oasis Valley(NV), *Nevada nuclear test sites.

Field sampling of springs and wells in Oasis Valley, Nev., provided information on the hydrologic and geochemical kinetic and solubility controls on the solute chemistry of the ground water. High dissolved sodium and silica associated with the tuffaceous aquifer indicate that hydrolysis and incongruent dissolution of rhyolitic glass are the principal reactions. Resultant dominant product phases, based on stability calculations, are montmorillonite and amorphous silica. Ground water infiltrates the valley alluvium from the tuffaceous aquifer through springs and subsurface flow. Colinear increases in sodium, bicarbonate, and chloride suggest that ground water in both aquifers has the same origin and that concentration increases in the alluvium are due to evapotranspiration. Progressive increases in the partial pressure of carbon dioxide and decreases in uncorrected C-14 ages demonstrate atmosphere-ground water interaction. A quantitative mass balance model based on sodium chloride conservation indicates excess calcium, magnesium, and sulfate being derived from local sources. Final concentrations of calcium and magnesium are controlled by calcite and dolomite saturation. Fluorite and silica are depleted due to precipitation of fluorite and silica gel. Calculations show 50 percent of total volume of ground water is discharged by evapotranspiration. (Woodard-USGS)
W79-10165

WATER QUALITY OF SELECTED STREAMS IN THE COAL AREA OF EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
P. W. McKinley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 840, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-142, April 1979. 49 p, 17 fig, 1 tab, 15 ref.

Descriptors: *Water quality, *Montana, *Streams, *Baseline studies, *Coal mines, Streamflow, Water analysis, Anions, Cations, Dissolved solids, Specific conductivity, Trace elements, Nutrients, *Potential coal-mining area, *East-central Montana, Big Dry Creek, Little Dry Creek, Timber Creek, Nelson Creek, Prairie Elk Creek, Sand Creek, Redwater River, Burns Creek.

In October 1975 the U.S. Geological Survey established a network of nine data-collection stations on eight streams in Montana to monitor water quality in potential coal-mining areas. The report summarizes and evaluates the water-quality data that have been collected during the first 2 years (3 years for 1 station) of network operation. Big Dry Creek, Little Dry Creek, Timber Creek, and Nelson Creek are the principal streams forming the Big Dry Creek basin, which is tributary to the Missouri River. These streams all contain water of the sodium sulfate type. Concentrations were high for dissolved solids (433-4,570 mg/L) and generally low for nutrients and trace elements. Prairie Elk Creek, Sand Creek, and the Redwater River flow directly into the Missouri River. Prairie Elk and Sand Creeks have mainly sodium bicarbonate water, whereas the Redwater River is predominately sodium sulfate water. All three streams contained water of high dissolved-solids concentration (160-3,370 mg/L) and generally low nutrient and trace-element concentrations. Burns Creek is tributary to the Yellowstone River. The water type is generally sodium sulfate during the spring and summer and sodium bicarbonate during the fall and winter. Water from Burns Creek ranged from 382 to 1,420 mg/L dissolved solids. (Woodard-USGS)
W79-10168

VARIATION OF RAIN CHEMISTRY DURING STORMS AT TWO SITES IN NORTHERN CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
V. C. Kennedy, G. W. Zellweger, and R. J. Avanzino.
Water Resources Research, Vol. 15, No. 3, p 687-702, June 1979. 13 fig, 4 tab, 37 ref.

Descriptors: *Chemistry of precipitation, *Rain water, *Chemical analysis, *Precipitation(Atmospheric), *California, Coasts, Data collections, Sites, Chlorides, Sodium, Calcium, Magnesium, Lead, Zinc, Manganese, Copper, Nitrogen, Bromine, Hydrogen ion concentration, *Rain chemistry, *Menlo Park(CA), *Petrolia(CA).

The chemical composition of rainfall at Menlo Park, on San Francisco Bay, is compared with rainfall at Petrolia, which is near the coast about 500 km north of San Francisco. Sequential samples representing 1.35 to 5.4 mm of rain were collected from November 1971 to January 1972. At rural Petrolia the Cl:Na ratio was that of sea water for Cl concentrations ranging from 0.02 to 38 mg/L. In metropolitan Menlo Park, the Cl:Na ratio in rain closely approximated that in sea water above about 0.5 mg/L Cl, but at lower Cl concentrations the ratio exceeded that in sea water, a fact attributed to the presence of anthropogenic Cl. Other constituents dissolved in Menlo Park rain (along with their concentration ranges in milligrams per liter), and believed derived at least in part from anthropogenic sources, were Ca (0.01-1.07), Mg (<0.01-1.08), Pb (0.003-.035), Zn (0.002-.013), Mn (0.0001-.0057), Cu (0.0008-.0024), NO3N (0.02-.54) and Br (<0.01-.12). The range of pH values was smaller in the rural than in the metropolitan areas; average H activity corresponded to a pH of 5.1 to 5.2 in both areas. At petrolia, pH decreased with increased dissolved salts in rainfall, but no relation between pH and dissolved salts was evident at Menlo Park. (Woodard-USGS)
W79-10178

2L. Estuaries

AN OVERVIEW OF THE RHODE RIVER WATERSHED PROGRAM,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A.
W79-10091

BARRIER ISLAND CONFIGURATION,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
R. Dolan, B. Hayden, and C. Jones.
Science, Vol. 204, No. 4391, p 401-403, 27 April 1979. 3 fig, 6 ref.

Descriptors: *Barrier islands, *Virginia, *Geomorphology, *Model studies, On-site investigations, Coasts, Shoals, Movement, Analytical techniques, *Cedar Island(VA), *Wallops Island(VA), *Cape Charles, *Assateague Island.

The 11 Virginia barrier islands are behaving as a chain and are undergoing rapid changes in shoreline configuration. If this trend continues for another 100 years, two capelike features will develop. The process responsible for this island-chain pattern may be a standing edge wave trapped between Assateague Island and Cape Charles. (Humphreys-ISWS)
W79-10244

INERTIAL WAVES IN THE GULF OF ST LAWRENCE: A STUDY OF GEOSTROPHIC ADJUSTMENT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
C. L. Tang.
Atmosphere-Ocean, Vol. 17, No. 2, p 135-156, 1979. 13 fig, 2 tab, 20 ref, 1 append.

Descriptors: *Internal waves, *Model studies, *On-site investigations, *Gulfs, *Canada, Mathematical models, Analysis, Analytical techniques, Theoretical analysis, Hydrodynamics, Waves(Water), Foreign research, Variability, Frequency, Fluctuations, *Gulf of St Lawrence, *Nova Scotia, Inertial waves, Two layer model.

It was shown that inertial oscillations of significant magnitude can be generated by geostrophic adjustment in a shallow sea. Evidence of them in current-meter data from the Gulf of St Lawrence was presented. The geostrophically unbalanced state required for the adjustment process is identified in the data by the occurrence of high accelerations of the currents. The difference between the inertial oscillations generated by different mechanisms and the intermittence and the frequency shift of the inertial waves were discussed. (Humphreys-ISWS)
W79-10245

HURRICANE SURGE POTENTIALS OVER SOUTHEAST LOUISIANA AS REVEALED BY A STORM-SURGE FORECAST MODEL: A PRELIMINARY STUDY,
National Weather Service, New Orleans, LA.
K. C. Crawford.
Bulletin of the American Meteorological Society, Vol. 60, No. 5, p 422-429, May 1979. 6 fig, 5 ref.

Descriptors: *Hurricanes, *Storm surge, *Louisiana, *Gulf of Mexico, *Model studies, Mathematical models, Winds, Waves(Water), Ocean waves, Coasts, Shores, Lakes, Bays, Water levels, Floods, Storms, Levees, Forecasting, Meteorology, *Lake Pontchartrain(LA), *New Orleans(LA).

A storm-surge model (SLOSH) developed in 1977 for Southeast Louisiana predicts sea, lake, and overland surges from hurricanes. Primary model output is the average of water level conditions over a finite geographical area. The model appears capable of providing definitive evidence for the varied impact of storm surges to future generations in Southeast Louisiana; however, model surge forecasts are governed strongly by the accuracy in describing the movement and intensity of tropical storms. A simplified initial study was undertaken to gain a physical understanding of, and insights on, the potential surges over Southeast Louisiana. A brief synopsis of the hurricane flood potential was given. (Sims-ISWS)
W79-10254

CARBON ISOTOPE RATIOS OF PARTICULATE ORGANIC MATTER IN THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
F. C. Tan, and P. M. Strain.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 678-682, June 1979. 3 fig, 3 tab, 20 ref.

Descriptors: *Organic matter, *Carbon radioisotopes, *Water quality, *Estuaries, Gulfs, On-site investigations, Plankton, Sampling, Testing procedures, Analytical techniques, Surveys, Data collections, Foreign research, *Gulf of St Lawrence.

Sixteen offshore surface samples within the Gulf of St. Lawrence showed low delta 13C values and were similar to 8 offshore surface samples collected seaward of the Gulf of St. Lawrence. The delta 13C surface values were consistent with delta 13C values in plankton produced at the temperature found in the euphotic zone in the study area. Higher values were observed in 4 surface samples from the mouth of the St. Lawrence Estuary and probably result from high carbon demand during periods of high biological productivity. Lower values found in 7 deep particulate organic matter (POC) samples indicate changes in the nature of the POC caused by biological degradation of the organic matter. Significant differences (2-6 parts per thousand) between the uniformly high delta 13C values of the organic carbon in surface sediments and the low values of near-bottom water POC have been observed. The similarity between the delta 13C values of surface water POC and the surface sediments suggests that surface water POC is an important source of organic carbon in surface sediments. Several observations of large vertical delta 13C gradients in deep water POC suggest the presence of resuspended sediments 30-60 m above the sediment-water interface. (Humphreys-ISWS)
W79-10258

PHYTOPLANKTON ECOLOGY OF THE STRAIT OF GEORGIA, BRITISH COLUMBIA,
Fisheries and Marine Service, Vancouver (British Columbia). Pacific Environment Inst.
For primary bibliographic entry see Field 5C.
W79-10261

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DOUBLE EFFECT FLOATING SOLAR STILL COMPRISING A SUBMERGED CONDENSING SYSTEM,
J. Eidelberg.
U.S. Patent No. 4,151,046, 3 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1378, April 24, 1979.

Descriptors: *Patents, *Desalination, *Water purification, Desalination apparatus, Solar stills, Solar distillation, Potable water, Condensation.

The double effect floating solar still for recovery of potable water from brackish or sea water, uses a partly immersed corrugated metal plate to heat the upper layer of a body of water in order to establish a temperature difference between the upper and lower sections of the still. The difference in temperature creates a difference in vapor pressures.

forcing the vapor produced in the hot section of the still to flow into a submerged condenser, giving up the heat of condensation to the surrounding water, preheating it before it reaches the stage of evaporation. (Sinha-OEIS)
W79-10259

3F. Conservation In Agriculture

METHOD OF TREATING WATER FOR HORTICULTURAL USES,
Fisons Ltd., London (England).
P. S. Atkins, and F. N. Wilson.
U.S. Patent No. 4,149,970, 8 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 1018, April 17, 1979.

Descriptors: *Patents, *Water treatment, *Monitoring, Nutrients, Plant growth, Plant growth regulators, Agricultural chemicals, Equipment, Nutrient film techniques(NFT).

A system is provided for growing plants using a nutrient film technique characterized in that a nutrient solution is circulated, the volume of circulating solution is monitored and is maintained at the desired level by the addition of water, plant nutrients being fed to the circulating solution in proportion to the water fed to the solution. The invention also provides a trough in which plants are adapted to grow and through which plant nutrient solution is adapted to circulate. The technique minimizes the build up of one chemical without a corresponding build-up of other chemicals, notably nutrient chemicals. (Sinha-OEIS)
W79-10322

EXTRACTORS,
G. J. Wieck.
U.S. Patent No. 4,149,676, 10 p, 11 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 926, April 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation practices, Irrigation efficiency, Equipment, Valves, Water extraction system.

An improved irrigation extraction system is described. An elongated extraction tube resting on sealing saddles on valved risers of a buried mainline is pulled along the mainline by a hydraulically driven capstan on the extraction tube pulling an anchored cable resting on saddles and guiding the tube into each saddle. The extraction tube spans two risers, and has a series of check valves receiving water from the saddles, and opens the valve of each riser as the tube comes into sealed engagement with the saddle of that riser and closes that valve just before the tube is moved out of that saddle. In an alternate embodiment, an extraction tube is moved along floating saddles by powered rollers engaging flanges on risers supporting the saddles, and levers on the risers are pivoted by the tube to actuate capstans to open spring closed valves in the risers. (Sinha-OEIS)
W79-10327

NONLINEAR SENSOR FOR CENTER PIVOT DRIVE CONTROL SYSTEM,
Toro Co., San Marcos, CA. (Assignee).
R. E. Hunter.
U.S. Patent No. 4,149,570, 7 p, 8 fig, 1 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 890, April 17, 1979.

Descriptors: *Patents, *Irrigation systems, *Irrigation practices, Irrigation efficiency, Application equipment, Center pivot irrigation system, Sensors.

An improvement in angularity sensors employed in center pivot irrigation systems is described. A center pivot irrigation system has self-propelled articulating span units mounting interconnected sections of water carrying conduit. Each span unit has motor means and motor control means for regulating the operation of the associated motor means to maintain the span units in a pre-determined relative alignment in a vertical plane revolving about a vertical line at the center pivot of the system. The control has angularity sensor means which is connected between span units for sensing in a substantially horizontal plane changes in angularity between the span units relative to the desired revolving vertical plane. The angularity sensor incorporates a flexible control rod connected to an actuator rod of the motor control allowing linear actuation of the motor control over a first portion of travel of the control rod and being rotatably stopped at the free end to cause flexure of the control rod and thereby, non-linear actuation of the motor control over a second portion of the movement of the control rod. (Sinha-OEIS)
W79-10328

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ADVANCED METHODOLOGY FOR STORM SEWER DESIGN--PHASE II,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
H. G. Wenzel, Jr., B. C. Yen, and W. H. Tang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 823, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Research Report No. 140, June 1979. 86 p, 18 fig, 17 tab. OWRT B-098-ILL(4).

Descriptors: Drainage systems, Optimization, Risks, Sewers, *Storm drains, *Urban drainage, *Urban runoff, Cost analysis, Dynamic programming, Flood damage, Flood routing, Hydraulic design, Hydrograph routing, Mathematical models, Operations research, Probability analysis, Storm runoff, Uncertainties.

This report describes further development of computer models for determining the diameter, slope and elevations of each pipe in a storm drainage system in which the layout and manhole locations are specified. The design procedure is based on a least-cost criterion and utilizes discrete differential dynamic programming as the search technique. In this phase of the study a detention storage capability has been added to the model using two approaches. The first approach requires the specification of a maximum allowable outflow and computes the required storage. The second approach determines the storage volume such that the sum of the storage and pipe system costs is a minimum. The procedure for computation of expected damage costs has been changed to reflect the variation of flood damage with flood volume. Also a surface runoff component has been added. This option uses the hydrograph generation portion of the Illinois Urbana Drainage Area Simulator model. Improved cost specification methods as well as flexible pipe elevation constraint capabilities have been added. The new developments are illustrated using two example basins.
W79-10082

TILE FLOW RESPONSE IN A LAYERED SOIL,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
M. F. Walter, R. D. Black, and P. J. Zwerman.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 577-581, May-June 1979. 12 fig, 10 ref.

Descriptors: *Tile drainage, *Flow, *On-site investigations, *New York, Sampling, On-site data collections, Data processing, Evapotranspiration, Rainfall, Precipitation(Atmospheric), Evaporation, Subsurface drains, Tile drains, Pollutants, Path of pollutants, Seasonal, Monthly, Soil water, Soil moisture, Agriculture, Tile flow.

Tile drainage data were collected and analyzed for a 16-yr period on 12 plots in central New York State. Seasonal evapotranspiration had a direct effect on average monthly tile flow. Of the recorded tile flow, 84% occurred in the crop dormant months of November through April. Average annual and monthly precipitation were not found to be good indicators of tile flow. (Sims-ISWS)
W79-10248

DRAINAGE BIBLIOGRAPHY FROM COMPUTER BASED DATA SOURCES,
Science and Education Administration, Orono, ME. North East Plant, Soil and Water Lab.
J. Bornstein, S. Garwood, C. W. Doty, and W. F. Ryan.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 529-531, May-June 1979. 3 fig, 6 ref.

Descriptors: *Data collections, *Drainage, *Bibliographies, Data storage and retrieval, Computers, Information exchange, Information retrieval, Publications, Abstracts, Technical writing, Agriculture, Agricultural engineering, Computer based data sources, Literature searching, Indexes.

The purpose of this paper was to list the data bases with possible references to drainage and to describe a procedure for compiling an individually tailored bibliography to cover any specific aspects of drainage from computer-based data sources or retrieval systems. Data bases were listed that include information on drainage topics. Only acronyms and names were included. (Froehlich-ISWS)
W79-10253

ELIMINATION OF OVERFLOW OF SEWER SYSTEMS,
W. Simon.
U.S. Patent No. 4,150,683, 11 p, 10 fig, 2 tab, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1255, April 24, 1979.

Descriptors: *Patents, *Sewers, *Combined sewers, Storm drains, Flow control, Runoff, Urban runoff.

A technique and an apparatus are provided for eliminating the overflow of combined sewers by adjusting the quantities of water which can flow into the interceptor sewer. This adjustment is achieved in such combined sewers through the regulation of the size of the interconnecting pipe between each catch basin and the lateral line. (Sinha-OEIS)
W79-10282

4B. Groundwater Management

INSTITUTIONAL ARRANGEMENTS FOR INTRASTATE GROUNDWATER MANAGEMENT: A COMPARATIVE ASSESSMENT USING VIRGINIA AS A CASE STUDY,
JBF Scientific Corp., Arlington, VA.
R. F. Ehrhardt, and S. Lemont.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 889, Price codes: A06 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, April 1, 1979. 100 p, 3 fig, 2 append. OWRT C-80032-P(8410)(1). 14-34-0001-8410.

Descriptors: *Institutions, *Institutional constraints, *Groundwater, *Political aspects, Water rights, Legal aspects, Administration agencies, Virginia, Economic feasibility, *Public administration, *Policy options, Innovative approaches, Economic incentives, Regulatory strategies.

Incidents of contamination of groundwater supplies are becoming more frequent at the same time as demands on the resource for industrial, commercial and residential use are growing rapidly. Surveys of past and present practices in intrastate groundwater management suggest that adequate institutional arrangements do not exist for effective management of the quantity and quality of the groundwater resource. In this report, alternative institutions from public administration theory and practice were examined for their applicability in helping safeguard supplied. In addition, political legal, social, and economic conditions in the Com-

monwealth of Virginia were used in developing a reference case to see which of the theoretically preferred institutional arrangements would be most feasible in real-world circumstances. It is concluded that groundwater management efforts in the example case are best focused at the local level of government, making use of existing governmental units, coordinated on a regional basis by the state, and employing a flexible management program composed of economic incentives as well as regulatory strategies. The preferred institutional arrangement also includes an 'active' emergency response capability by which it conducts rehabilitation procedures for contaminated groundwater sources where necessary, and assesses the responsible party for the cost of remedial action. The report recommends that groundwater managers continue to move ahead with innovative approaches to the resolution of groundwater problems and emphasizes the inherent technical and political uncertainties in natural resources management.
W79-10235

4C. Effects On Water Of Man's Non-Water Activities

LAKE JACKSON WATERSHED STUDY: DESCRIPTION OF SITES, METHODOLOGY AND SCOPE OF RESEARCH,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10087

4D. Watershed Protection

FILTRATION OF SEDIMENT BY SIMULATED VEGETATION I. STEADY-STATE FLOW WITH HOMOGENEOUS SEDIMENT,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
B. J. Barfield, E. W. Tollner, and J. C. Hayes.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 540-545, 548, May-June 1979. 7 fig, 3 tab, 16 ref.

Descriptors: *Filtration, *Sediments, *Grassed waterways, *Model studies, Mathematical models, Filters, Sediment transport, Suspended solids, Grasses, Vegetation, Vegetation effects, Deposition(Sediments), Sedimentation, Steady flow, Sedimentology, Water quality control.

The control of sediment production from disturbed areas is a significant problem to engineers and others concerned with pollution control. The most common method used for controlling sediment production from construction sites is that of sediment retention structures. One alternative sediment control method, recommended by the EPA is the use of vegetal filters. In addition, the Soil Conservation Service accepts the use of grass strips to reduce peak runoff in areas where it is feasible. Peak flow is reduced by the combined effects of increased infiltration and delayed runoff. One severe limitation on the design of vegetal filters is the lack of information on the sedimentation process in filter media. The development of design recommendations for using grass strips as a standard practice for sediment control would be possible if a model were available to predict the movement and deposition of sediment in a filter media. In this report, a model was presented for making these predictions for steadystate flow conditions. The model was based on studies of hydraulics of flow, sediment transport, and deposition profiles conducted in an artificial rigid media. The final result was a model that has a good potential for adaptation to field conditions with actual grasses, non-homogeneous sediment, and unsteady-state flow rates. (Sims-ISWS)
W79-10252

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

STUDIES ON VIRUSES IN WATER,
Utah Water Research Lab., Logan.
R. S. Spendlove, B. B. Barnett, D. B. George, D. J. Adams, and S. F. Hayes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 880, Price codes: A03 in paper copy, A01 in microfiche. Water Quality Series, UWRL/Q-79/02, July 1979. 35 p. OWRT A-040-UTAH(1), 14-34-0001-8047.

Descriptors: *Viruses, Antigens, Monitoring, Bacteriophages, Filtration, Water treatment.

A new procedure for the detection of viral antigens in fecal material was developed. The test is performed by first diluting a fecal sample with phosphate buffered saline to give a liquid consistency. The pH is then adjusted to 8.5-9.0 and the solids are allowed to settle for five minutes. Supernatant fluid from above the fecal sediment is placed on the upper surface of a well of an inverted Immulon microtiter plate and incubated for one hour at 37 degrees C to allow virus to adsorb to the plastic. The Immulon plate is then washed three times with a Tween 20 solution and dried. Adsorbed virus is stained with fluorescein labeled antiviral antibody containing Evan's Blue dye. The stained preparations are examined by epi-fluorescence microscopy for the presence of viral aggregates and virus-containing cellular membranes. The test is applied in a continuous water monitoring procedure that can be used to supplement methods in which infectious viruses are isolated from water Granular media filtration systems (i.e., sand, anthracite coal and sand; anthracite coal, sand and garnet) are ineffectual in the removal of the bacteriophage MS 2 from water when used as in-line direct filters. Batch assays have indicated a 93 percent reduction of MS 2 can occur when polyelectrolytes are added to the water In addition, alum concentrations of 20, 30, 40, and 50 mg/l remove 80 to 98 percent of the virus by precipitation. No reduction of MS 2 was observed at alum concentrations from 1 to 10 mg/l.
W79-10083

LAKE JACKSON WATERSHED STUDY: DESCRIPTION OF SITES, METHODOLOGY AND SCOPE OF RESEARCH,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A
W79-10087

AN OVERVIEW OF THE CHOWAN RIVER RURAL RUNOFF STUDY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
F. J. Humenik, W. S. Galler, J. W. Gilliam, D. W Hayne, and D. H. Howells
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254 Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 51-66, 1977.

Descriptors: *Runoff, *Watersheds(Basins), *Pollutants, *Sampling, *Virginia, *North Carolina, Water pollution, Water pollution sources, Path of pollutants, Instrumentation, Laboratory tests, Pollutant identification, Plankton, Nutrients, Algae, Rural areas, Agriculture, Agricultural watersheds, *Chowan River Basin(VA-NC).

The rationale and working basis for this three-year study in the Chowan River Basin of Virginia and North Carolina were reviewed. The major thrust of the co-investigative group was to determine the feasibility of statistical scientific sampling for the evaluation of rural runoff and also for the identification and interpretation of nonpoint sources Data for making feasibility judgments are being obtained on two small conveniently located subareas of the Chowan River Basin because they were judged to represent the four types of land that together constitute most of the basin; thus this arbitrary (as opposed to random) selection of parts of the basin would provide information on four land types or four physiographic regions: (1) poorly-drained Coastal Plain, (2) well-drained Coastal Plain, (3) agricultural Piedmont, and (4) silvicultural Piedmont. Field sampling to obtain flow and quality data are procured by grab sampling and flow meter methodologies at all sites and by stage recorders and automated samplers activated by stage differences at five sites which are also grab sampled. (See also W79-10084) (Sims-ISWS)
W79-10088

WATERSHED RESEARCH IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
J. G Ogden, III.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 67-82, 1977. 2 fig, 4 tab, 5 ref.

Descriptors: *Watersheds(Basins), *Runoff, *Streamflow, *Hydrogen ion concentration, *Pollutants, Air pollution, Water pollution, Water pollution sources, Drainage, Chemicals, Cations, Heavy metals, Pollutant identification, Precipitation(Atmospheric), Rainfall, Hydrographs, Forests, Forest watersheds, *Nova Scotia.

In addition to several federal and provincial agencies which maintain numerous water quantity and water quality sampling stations throughout the province, 6 small watersheds are instrumented for input/output investigations. Three watersheds are designated as I.H.D. hydrologic stations and are limited to precipitation, stream, and groundwater runoff with occasional water chemistry measurements related to groundwater composition. In 1977, 3 watersheds were instrumented with multiple bulk precipitation samplers, as well as specific event samplers. Watershed outlet water chemistry measurements were quantitatively sampled for major ions to determine input/output for each watershed Major concern was for effects of precipitation which in recent years has decreased to average pH values of 3.5 to 4.7 with conductivities in the range of 20 to 80 micromhos/cm on nutrient loss from Nova Scotia ecosystems. Seasonal event sampling for heavy metals as well as major ions were selected on the basis of storm origin, designated as Atlantic, Eastern Seaboard, and Great Lakes. (See also W79-10084) (Sims-ISWS)
W79-10089

THE MAHANTANGO CREEK WATERSHED--AN INTERDISCIPLINARY WATERSHED RESEARCH PROGRAM IN PENNSYLVANIA,
Science and Education Administration, University Park, PA Northeast Watershed Research Center.
For primary bibliographic entry see Field 2A.
W79-10090

AN OVERVIEW OF THE RHODE RIVER WATERSHED PROGRAM,
Smithsonian Institution, Edgewater, MD Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A
W79-10091

WALKER BRANCH WATERSHED ELEMENT CYCLING STUDIES: COLLECTION AND ANALYSIS OF WETFALL FOR TRACE ELEMENTS AND SULFATE,
Oak Ridge National Lab., TN
For primary bibliographic entry see Field 2K.
W79-10092

PRECIPITATION AND NUTRIENT EXPORT FROM A SMALL COASTAL ECOSYSTEM IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept of

Biology.
For primary bibliographic entry see Field 2K.
W79-10093

NUTRIENT LOADING OF THE RHODE RIVER WATERSHED VIA LAND USE PRACTICE AND PRECIPITATION,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10094

NUTRIENT DISCHARGE FROM WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-10100

NUTRIENT EXPORT FROM THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5B.
W79-10101

NUTRIENT YIELD ASSESSMENT BY DIFFERENT SAMPLING STRATEGIES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-10102

THE MAHANTANGO CREEK WATERSHED--SOURCE AND REACTION OF PHOSPHATE DURING STORM HYDROGRAPHS,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
W79-10104

NUTRIENT DISCHARGE FROM RHODE RIVER WATERSHEDS AND THEIR RELATIONSHIP TO LAND USE PATTERNS,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10105

DYNAMICS OF TRACE ELEMENT EXPORT FROM A DECIDUOUS WATERSHED, WALKER BRANCH, TENNESSEE,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-10116

LAND UTILIZATION AND METALS DISCHARGE FROM THE RHODE RIVER WATERSHED,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10117

RUNOFF STUDIES OF THE AGRICULTURAL HERBICIDES ALACHLOR AND ATRAZINE FROM THE RHODE RIVER WATERSHED DURING THE 1976 GROWING SEASON,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10118

SAMPLING METHODOLOGIES FOR ASSESSING RURAL RUNOFF,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W79-10121

PROBABILITY SAMPLING OF SMALL STREAMS: PROBLEMS AND RESULTS,
North Carolina State Univ. at Raleigh. Inst. of Statistics.
For primary bibliographic entry see Field 7B.
W79-10122

PHYSIOLOGICAL DYSFUNCTION OF THE HAEMOPOIETIC SYSTEM IN A FRESH WATER TELEOST, LABEO ROHITA, FOLLOWING CHRONIC CHLORDANE EXPOSURE. PART II-ALTERATIONS IN CERTAIN ORGANIC COMPONENTS AND SERUM ELECTROLYTES,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
S. K. Bansal, S. R. Verma, A. K. Gupta, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 674-680, 1979. 1 tab, 23 ref.

Descriptors: *Pesticide toxicity, *Fish physiology, *Electrolytes, Chemical analysis, Animal metabolism, Carbohydrates, Lipids, Chlorinated hydrocarbon pesticides, Mortality, Magnesium, Chlorides, Phosphorus, Iron, Sodium, Calcium, *Hematology, *Tissue analysis, *Chlordane.

The present study was undertaken to evaluate the effects of chlordane on the blood chemistry of a fresh water teleost, L. rohita after 60 days treatment at concentrations of 17, 23, 35 and 70 microgr/L. The elevated blood sugar level (hyperglycaemia) indicates a disrupted carbohydrate metabolism, which may be mainly due to the enhanced breakdown of liver glycogen (glycogenolysis), mediated perhaps by adrenocortical hormones and reduced insulin secretory activity. The observed elevation of blood glucose increased with increased exposure concentration. Cholesterol, phospholipids and triglycerides showed significant decreases while free fatty acids were increased. The major serum electrolytes Na and Cl were highly correlated and significantly increased. In addition, serum Ca and Mg were also significantly elevated. Increased mortality at higher chlordane concentrations may be due to disruption of osmoregulatory mechanisms. (See also W79-10186) (Deal-EIS)
W79-10187

EFFECTS OF TEMPERATURE ON DOMINANT MACROZOOBENTHOS SPECIES OF THE RIVER SAVA UNDER LABORATORY CONDITIONS,
Zagreb Univ. (Yugoslavia). Faculty of Natural Sciences and Mathematics.
M. Mestrov, N. Krkac, M. Kerovec, A. Lui, and R. Lattinger-Penko.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1910-1914, 1978. 1 tab, 10 ref.

Descriptors: Bioassay, Laboratory test, Benthos, Freshwater, Invertebrates, *Fresh water macrobenthos, *Mortality, *Water temperature, *Thermal shock, *Acclimation, Acclimation temperature, Molluscs, Oligochaetes, Amphipoda, Aquatic insects, Water pollution effects, Methodology.

Experiments show that a sudden rise in water temperature from 5 to 15 degrees C have no harmful effects on most common invertebrate benthos. Physa, however, has a serious mortality rate and Chironomus was provoked to a premature metamorphosis. All invertebrates acclimatized to 10, 15 and 20 degrees C can withstand thermal shocks up to the maximum tolerance limits with no serious consequences. The majority of species tolerate temperature up to 28 degrees C, Erpubdella and Physa up to 30 degrees C. (Katz-EIS)
W79-10188

EFFECTS OF ORGANIC WASTE ON PRIMARY AND SECONDARY PRODUCTION IN THE EMS-DOLLARD ESTUARY,
Nederlands Inst. voor Onderzoek der Zee, Texel.
P. DeWolf.
Hydrobiological Bulletin, Vol. 12, No. 3/4, p 260-272, 1978. 6 fig, 3 tab, 26 ref.

Descriptors: *Organic wastes, *Toxicity, *Primary productivity, *Secondary productivity, Industrial wastes, Estuaries, Sewage effluents, Turbidity, Biochemical oxygen demand, Phytoplankton, Benthic fauna, Biomass, Growth rates, Ems-Dollard Estuary, Netherlands, Domestic wastes.

The Ems-Dollard estuary receives large amounts of organic waste from the hinterland and there is imported organic material from the North Sea. Taken together the amount of allochthonous organic material is about 800 g C/m2/year in the Dollard. This import results in a very high turbidity, a low primary production of phytoplankton as well as phytobenthos, and a low standing stock of macrobenthos. The role of imported organic material as a source of food for this fauna is discussed. (Deal-EIS)
W79-10192

MERCURY IN THE AQUATIC ECOSYSTEMS OF THE PROVINCE OF QUEBEC, CANADA (IN FRENCH),
Environmental Protection Service, Montreal (Quebec).
C. E. Delisle.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1947-1955, 1978. 1 fig, 3 tab, 18 ref. (English Summary).

Descriptors: *Mercury, *Freshwater fish, Estuaries, Quebec, *Canada, *Crustaceans, Clams, Mussels, Crabs, Shrimp, Lobsters, Benthos, Zooplankton, Pike, Muskellunge, White fish, Trout, Bass, Yellow perch, Sturgeon, Marine fish, Surface water, Rain water, Snow.

The purpose of this paper is to give a general overview of the present knowledge regarding mercury in the aquatic ecosystems of Quebec. Different investigators have collected biological and physical materials for Hg analysis. Their results are summarized. The mercury content of various freshwater and marine fish and invertebrates average between 0.19 ppm in white fish and 3.0 ppm in crabs, shrimp and lobsters. Of the freshwater fish species, pike and muskellunge average 0.92 ppm. (Katz-EIS)
W79-10194

HEAVY METAL CONCENTRATIONS AND PHYTOPLANKTON PRODUCTION, BIOMASS AND STRUCTURE IN A NORTHERN ESTUARINE AREA OF THE BALTIC SEA,
Salt and Water Ltd., Helsinki (Finland).
K. Pietilainen, and T. Melvasalo.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1963-1969, 1978. 3 fig, 4 tab, 10 ref.

Descriptors: Metals, *Iron, *Zinc, *Manganese, *Lead, *Zooplankton, Chlorophyll, *Primary productivity, Biomass, Baltic Sea, Finland, Eutrophication, Industrial wastes, Domestic wastes, Cyanophyta, Water quality, Chemical analysis, Particulate matter, Nutrients, Steel industry.

Effluents from metal and steelworks are discharged into a northern estuarine area of the Baltic Sea. Studies indicated a strong positive correlation between chlorophyll a and iron, manganese, and zinc. Phytoplankton biomass correlated positively with iron and zinc. The biomass of Cyanophyta correlated best with manganese. The maximum primary productivity coincided with the maximum of iron and manganese, whereas none of the biological parameters correlated with lead. (Katz-EIS)
W79-10197

RATIO ATP/CHLOROPHYLL AS AN INDEX OF RIVERS' WATER QUALITY,
Istituto di Ricerca Sulle Acque, Rome (Italy).
G. Chiaudani, and R. Pagnotta.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol 20, Part 3, p 1897-1901, 1978. 2 fig, 2 tab, 11 ref

Descriptors: Water pollution effects, *Monitoring, *Enzymes, Chlorophyll, *Phytoplankton, Water quality, *Chemical analysis, Eutrophy, Domestic

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wastes, River Tiber, Italy, ATPase, Chlorophyll, Dissolved oxygen, Chemical oxygen demand, Ammonium compounds.

Investigations on the Tiber River, Italy indicate that the crude ATP/chlorophyll ratio is significantly correlated with chemical parameters. This ratio is suggested as a valuable and rapid tool for detecting changes in water quality in rivers which are eutrophic or receive domestic wastes. The ATP/chlorophyll ratio is regarded as a good way to calculate the autotrophic index. Further research on a greater variety of rivers is needed. (Katz-EIS)
W79-10198

EFFECTS OF EXPERIMENTAL OIL SPILLS ON CHIRONOMIDAE IN ALASKAN TUNDRA PONDS,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
S. C. Mozley.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1941-1945, 1978. 4 fig, 1 tab, 4 ref.

Descriptors: Oil, *Oil spills, *Water pollution effects, On-site-investigation, Methodology, Aquatic insects, *Chironomids, Water birds, Alaska, Point Barrow, *Benthos, Stoneflies, Toxicity, Mortality, Prudhoe Bay crude oil, Reproduction.

A study was made of the effects of Prudhoe Bay crude oil spilled on four tundra ponds near Point Barrow, Alaska. Initially oil killed macroinvertebrates only in peripheral areas when they could contact it on plants and at the surface. In one treated pond one species Trichotonypus was virtually eliminated but in another pond an unusually large population became reestablished. The residual slick interfered with mating and oviposition of chiromonids among the plants. Major oil spills could eliminate a major food resource for breeding birds. (Katz-EIS)
W79-10199

INTRODUCTION OF WASTE HEAT AND EFFECTS ON MICROORGANISMS,
Bundesanstalt fuer Gewasserkunde, Coblenz (Germany, F.R.).
M. Wunderlich.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1855-1860, 1978. 2 fig, 4 tab, 5 ref.

Descriptors: *Water temperature, Water pollution effects, *Thermal pollution, Thermal stress, Industrial wastes, Rivers, *Thermal power plants, River Rhine, Microorganisms, Cooling water, *Aquatic bacteria, *Aquatic fungi, Bioassay, Laboratory tests, Respiration, Oxygen consumption, Aquatic fungi, Phytoplankton, Enzymes.

The results show that, besides the warming-up range, the absolute temperature reached exerts a significant influence on aquatic microorganisms. Warming-up to 30C produces effects on the growth of phytoplankton, fungi and psychorophilic bacteria. From 40C upward, mesophilic bacteria are damaged and a thermic activation of bacterial dormancy stages is initiated. Conclusions were based on laboratory studies and as a result of two field observations of the River Rhine from Karlsruhe to the Dutch border. Laboratory studies observed the change in oxygen consumption of bacteria, the changes in the dehydrogenase activity of saprophytic water bacteria. (Katz-EIS)
W79-10200

INFLUENCE OF BEDLOAD TRANSPORT ON THE MACROBENTHOS OF RUNNING WATERS,
Bonn Univ. (Germany, F.R.). Inst. fuer Landwirtschaftliche Zoologie und Bienenkunde.
M. Petran, and P. Kothe.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1867-1872, 1978. 6 fig, 8 ref.

Descriptors: *Benthos, *Aquatic insects, *Oligochaetes, Tubificids, Sediments, Particle size, Substrate, Currents(Water), Biological indicator, *Bedload transport, Grain size, Danube River, Rhine River, Macrobenthos, Environmental effects, Upper Rhine River, Running waters.

Field investigations as well as experiments demonstrated bedload transport acting as an important ecological factor on benthonic organisms. In the running waters of the Danube and Upper Rhine, which were investigated only some species of Naididae and Tubificidae were able to colonize benthic areas with shifting substrate. In the substrate layer underneath the shifting gravel having a high rate of water exchange these organisms find optimal living conditions. Here they can even occur in higher abundances than in stable substrate. All of the other species were not able to colonize areas of shifting substrate. The composition of benthos can be used as a biological indicator for the stability of the substrate. This biological indication is applicable for the estimation of the location and the width of bedload transport in a river. (Katz-EIS)
W79-10201

RELATIVE TOLERANCE OF SOME SALMONIDS TO ACID WATERS,
Norsk Inst. for Vannforskning, Blindern.
M. Grande, J. P. Muniz, and S. Andersen.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 2076-2084, 1978. 6 fig, 4 tab, 20 ref

Descriptors: Freshwater fish, Brown trout, *Brook trout, Rainbow trout, Atlantic salmon, Lakes, On-site-investigation, Hydrogen ion concentration, *Acidic water, *Acidity, Bioassay, *Mortality, Water pollution effects, Water pollution sources, Norway, *Acid snowmelt, Water, Lake Langtjern

Experiments have been performed to study the tolerance of different species of salmonids to acid waters (pH 4.4-5.5). Brown trout (Salmo trutta L.), brook trout (Salvelinus fontinalis Mitchill), rainbow trout (Salmo gairdnerri Richardson), Atlantic salmon (Salmo salar L.) and hybrids between char species were stocked in small and medium-sized acid lakes and tested in tanks to compare their relative survivals. These species can be ranked in the order brook trout, brown trout, Atlantic salmon and rainbow trout, with brook trout as the most tolerant to low pH. Factors other than pH, such as genetic variability, age of fish, physical conditions and water quality may influence this ranking. (Katz-EIS)
W79-10202

MUDDY OFF-FLAVOUR IN BREAM (ABRAMIS BRAMA L.) FROM THE PORVOO AREA, GULF OF FINLAND,
Helsinki Univ. (Finland). Dept. of Limnology.
P.-E. Persson.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 2098-2102, 1978. 2 tab, 33 ref.

Descriptors: *Eutrophy, *Municipal sewage, Freshwater fish, Estuaries, Finland, Baltic Sea, Porvoo, Algae, Phytoplankton, Blue-green algae, Oscillatoria agardhii, Odor, *Odor-producing algae, Geosmin, Actinomycetes, Bream, Abramis Brama, Gulf of Finland.

This investigation was regarding the muddy off-flavour in bream (Abramis brama) from a dilute brackish water bay near Porvoo, on the south coast of Finland. The bay is extremely eutrophic due to municipal sewage. Muddy off-flavours in bream developed when the biomass of the blue-green alga Oscillatoria agardhii reached its peak (21.8 mg/l, corresponding to 69.3% of total phytoplankton biomass). Since some strains of O. agardhii produce geosmin, it could be the cause of the off-flavours in the study area, also. Earthy-smelling actinomycetes were present in the water throughout the investigation, and may have contributed to the off-flavours. (Katz-EIS)
W79-10203

A HYPOTHESIS TO EXPLAIN THE DISTRIBUTION OF NATIVE TROUT IN A DRAINAGE OF MONTANA'S BIG HOLE RIVER,
Claremont Graduate School, CA. Dept. of Joint Science.
C. R. Feldmeth, and C. H. Eriksen.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 2040-2044, 1978. 2 fig, 1 tab.

Descriptors: Freshwater fish, Montana, *Big Hole River, Cutthroat trout, Grayling, Odell Lake, *Water temperature, Oxygen, *Oxygen minima, Fish physiology, Bioassay, Methodology, Environmental effects, *Fish behavior, Fish migration, Fish population.

A study was made in Odell Lake, Montana, to determine the environmental factors affecting the distribution of southern grayling and cutthroat trout in the Big Hole River. In particular, the fishes comparative tolerance to high temperatures and to oxygen minima was observed. Grayling adults lost equilibrium at 26.9 degrees C and adult cutthroat at 27.1 degrees C. The oxygen tolerance of both species were about the same about 2.2 ppm O2 at 17-18 degrees C and 16.6 ppm O2 at 4-5 degrees C. (Katz-EIS)
W79-10204

THE PRESENT STATE OF FISHING IN LESTIJOKI, A SMALL RIVER IN FINLAND,
Oulu Univ. (Finland).
T. Valtonen, and A. Niemi.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 2085-2091, 1978. 3 fig, 2 tab, 10 ref.

Descriptors: Brown trout, Crayfish, Lampreys, *Iron, *Acid water, *Hydrogen ion concentration, Freshwater fish, On site investigation, Lestijoki River, Finland, Bay of Bothnia, Water quality, Suspended solids, *Humic acid, Water pollution, Sources.

The Lestijoki is a small river in Finland which flows into the Bothnian Bay. The water of the river has much humus and is acidic. Domestic wastes are discharged into the river. Iron content has been observed to be 1.71 to 2.08 mg/l and the pH varies between 5.3 and 7.1. There is no evidence that the trout, crayfish or river lamprey are affected by water quality. The trout fishery is badly mismanaged. (Katz-EIS)
W79-10205

EFFECT OF THE GREEN ALGAE SCENEDESMUS OBLIQUUS AND CHLORELLA VULGARIS ON HETEROTROPHIC BACTERIA IN POLLUTED WATERS,
Hebrew Univ., Jerusalem (Israel). Human Environmental Sciences Lab.
I. Dor.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1930-1933, 1978. 7 fig, 7 ref.

Descriptors: Algae, *Phytoplankton, *Scenedesmus, *Chlorella, *Bacteria, Heterotrophic bacteria, Water pollution sources, Bioassay, Water pollution effects, Waste disposal, Waste water treatment, Sewage, Bacterial inhibition, Sewage bacteria, Sewage effluents.

The green algae Scenedesmus obliquus and Chlorella vulgaris compete for nutrients with heterotrophic bacteria. Algae which eliminate bacterial competition by the production of inhibiting substances which are effective against a large spectrum of heterotrophic bacteria have success in variously polluted waters. Laboratory tests indicate that an algal culture filtrate can inhibit several strains of sewage bacteria. (Katz-EIS)
W79-10207

USE OF BIOTIC INDICES AS A TOOL FOR WATER QUALITY ANALYSIS IN RIVERS,
Norsk Inst. for Vannforskning, Blindern.
G. F. Jorgensen.
Verhandlungen Internationale Vereinigung fur

Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1772-1778, 1978. 3 fig, 2 tab, 6 ref.

Descriptors: Biota, *Benthos, *Monitoring, *Rivers, Norway, Great Britain, Animal populations, *Animal groupings, Biotic index, Norwegian rivers, Stoneflies, Mayflies, Caddisflies, Amphipoda, Gammarus, Aquatic insects, Oligochaetes, River Nitelva, River Fjellhamarelva, Water quality, Biological monitoring.

Benthic communities which respond to the combined impact of various environmental factors may be regarded as a potential permanent monitoring system. Biological data combined with a consideration of chemical, hydrological data may provide a basis for water management decisions. Four different biological indices were tested to determine their suitability for Norwegian waters. Indices derived from studies of British rivers fit fairly well the circumstances of the Norwegian rivers. (Katz-EIS)
W79-10208

THE DISSOLVING OF SOME PHOSPHORUS MINERAL COMPOUNDS BY MICRO-ORGANISMS IN THE BOTTOM SEDIMENTS OF FERTILIZED LAKES (IN POLISH),
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
S. Niewolak, A. Korycka, and K. Krasnicki.
Roczniki Nauk Rolniczych, Series H, Vol. 99, No. 1, p 141-174, 1978. 8 tab, 5 fig, 98 ref.

Descriptors: *Lakes, *Nutrients, Water quality, Fertilization, Fertilizers, *Phosphorous compounds, Bacteria, *Micro-organisms, Poland, Mazurian Lakes, Nitrogen compounds, Ammonium compounds, Aerobic bacteria, On-site-investigation.

The study includes the results of investigations on dissolving by micro-organisms of tricalcium phosphate, ferrous phosphate and super-Thomas slag in the bottom sediments of Lakes Czarna Kuta, Dgal Maly, Piecek and Smolak in the vicinity of Wegorzewo in the Mazurian Lake Region. The lakes were fertilized with commercial fertilizers (lime, ammonium nitrate, super-Thomas slag, potassium salts). The investigations were conducted over the period 1972-1974. Of the bacteria dissolving mineral phosphorus compounds aerobic bacteria occurs mainly, anaerobic being found in smaller numbers. Actinomycetes and fungi were rarely found and in amounts not exceeding several colonies in 1 g of sediment dry matter. Bacteria dissolving tricalcium phosphate, ferrous, phosphate and super-Thomas slag occurred more numerously in the surface layers of the bottom sediments of the Wegorzewo Lakes (0 to 5 cm). Their numbers decline as depth of the lake bottom was increased. The greatest number of bacteria dissolving tricalcium phosphate and super-Thomas slag was found in the bottom sediments of Lake Czarna Kuta (4,430,000 and 4,560,000 cells per g of dry matter respectively) dissolving ferrous phosphate in the sediments of Lake Smolak (up to 10,500,000 cells per 1 g of dry matter). (Katz-EIS)
W79-10209

AMMONIFICATION PROCESSES IN FERTILIZED LAKES,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
S. Niewolak, A. Korycka, and E. Potocka.
Ekologia Polska, Vol. 26, No. 4, p 555-572, 1978. 10 fig, 20 tab, 20 ref.

Descriptors: *Lakes, *Bacteria, *Nitrogen, Microorganism, *Nutrients, Ammonification, Ammonium compounds, Poland, Nitrogen fixing, Nitrogen cycle, Fertilization, Fertilizers, Masurian Lakes, Ammonifying microorganisms, Water temperatures.

Changes in the number of ammonifying bacteria and the ammonification rate in water and bottom sediments of lakes Czarna Kuta, Dgal Maly, Piecek and Smolak of the Masurian Lakeland, fertilized with mineral salts in 1971-1974, were investigated. The ammonifying bacteria are more abundant in the water close to the bottom and in the surface (0-5 cm) layer of bottom sediments of lakes examined. Their numbers increase from spring to summer, attaining the maximum after each fertilization in May, June and July. Simultaneously, the potential ammonification activity at 25 degrees C and at the actual temperature occurring in the lakes increases and sometimes also the NH4-N content in lake water. (Katz-EIS)
W79-10210

THE ADAPTATION OF DIGESTIVE ENZYMES TO TEMPERATURE, SEASON AND DIET IN ROACH, RUTILUS RUTILUS L. AND RUDD SCARDINIUS ERYTHROPHTHALMUS L. I. AMYLASE,
Innsbruck Univ. (Austria). Inst. fuer Zoophysiologie.
R. Hofer.
Journal of Fish Biology, Vol. 14, p 565-572, 1979. 7 fig, 18 ref.

Descriptors: *Enzymes, *Seasonal, *Fish physiology, Digestion, Water temperature, Fish food organisms, Fish diets, Animal metabolism, Biochemistry, Food habits, *Roach, *Rudd.

Seasonal changes of the amylolytic activity in the gut content of roach and rudd in four Tyrolean lakes and the adaptation of the amylase to four acclimation temperatures and to different natural foods were studied. In roach amylolytic activity varied with the environmental temperature. Between September and October, however, enzyme activity shifted to a higher level where it remained for the entire cold season. In rudd, which has almost the same seasonal pattern of amylolytic activity as the roach, the activity of the enzyme is independent of environmental temperature. This suggests an endogenous rhythm of enzyme activity. (Deal-EIS)
W79-10211

STUDIES ON THE TOXICITY OF A FEW PESTICIDES ON COLISA FASCIATUS AND NOTOPTERUS NOTOPTERUS WITH REFERENCE TO HISTOPATHOLOGY AND HISTOCHEMISTRY. PART 1: BIOASSAY STUDIES,
D.A.V. Coll. Muzaffarnagar (India). Dept. of Zoology.
S. P. Gupta, S. R. Verma, and R. C. Dalela.
Acta hydrochimica et hydrobiologica, Vol. 7, No. 2, p 223-238, 1979. 6 tab, 40 ref.

Descriptors: *Pesticide toxicity, *Aldrin, *Fish behavior, Freshwater fishes, Animal pathology, Bioassay, Mortality, Lethal limit, Water temperature, Dissolved oxygen, Hydrogen ion concentration, *Organophosphorus pesticides, *Chlorinated hydrocarbon pesticides, *Parathion.

An attempt has been made to study the toxicity of two commonly used pesticides aldrin (organochlorine) and ethyl-parathion (organophosphorous) to the fish Colisa fasciatus and Notepterus notopterus. During bioassay studies, the behavior of the fishes was recorded. The aldrin concentration used lies between 0.021 mg/l and 0.042 mg/l for C. fasciatus and 0.00056 mg/l and 0.00135 mg/l for N. notopterus. The ethyl-parathion concentration used lies between 1.8 mg/l and 3.7 mg/l for C. fasciatus and 0.49 mg/l and 1.00 mg/l for N. notopterus. The effect of lethal aqueous concentrations of pesticides on the fishes prior to death are usually manifested by excitation, erratic swimming ability, difficulty in respiration, increasing in ventilation rate, jerky movements of body and fin fast, up- and downward movements, convulsions, loss of equilibrium, loss of the original colour of the body skin and the excess secreation of muens by the gills and the body wall. The TLm values for 24, 48 and 96 hours of exposition are determined for both species of fish and both pesticides at the following variables: three levels of temperature; three levels of dissolved oxygen; three levels of pH; and three fish sizes. The harmless concentration to C. fasciatus ranged from 0.0049 mg/l to 0.0161 for aldrin, 0.54 mg/l to 0.99 mg/l for ethyl-parathion and to N. notopterus from 0.00012 mg/l to 0.00045 mg/l for aldrin, 0.10 mg/l to 0.21 mg/l for ethyl-parathion. (Deal-EIS)
W79-10212

MERCURY CIRCULATION IN AQUATIC BIOCONESES, PART 1: MERCURY (II)-METABOLISM IN PHYTOPLANKTON,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia).
B. Havlik, J. Stary, J. Prasilova, K. Kratzer, and J. Hanusova.
Acta hydrochimica et hydrobiologica, Vol. 7, No. 2, p 215-227, 1979. 3 fig, 24 ref.

Descriptors: *Mercury, *Absorption, *Phytoplankton, Chlorella, Scenedesmus, Cyanophyta, Metabolism, Path of pollutants, Chemical reactions, Tracers, Enzymes, *Microcystis, *Bioaccumulation.

The metabolism of inorganic mercury has been studied in stationary cultures of planktonic algae (Chlorella kessleri, Scenedesmus obliquus and Microcystis incerta that were exposed for 14 days to the concentration of 0.0000002 M of Hg. Individual chemical forms of mercury were determined in algae and in the culture medium at regular intervals. All the studied phytoplankton species started to metabolize mercury immediately after its application, with the exception of the blue-green alga Microcystis incerta. The accumulation of mercury proceeds without interruption till the end of the experiment. After a 14 day cultivation about 60 - 80% of added mercury was present in algal cells and the portion of mercury washable from the cell surface did not exceed 2%. It was found that more than 99.5% of mercury in cultivation medium and more than 99.5% of mercury in algae was present in the form of Hg(II). A transformation of inorganic mercury to methyl-, or phenyl-mercury due to the action of algae was not observed. (Deal-EIS)
W79-10213

ALUMINUM SULFATE (ALUM) FOR PRECIPITATING CLAY TURBIDITY FROM FISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquaculture.
C. E. Boyd.
Transactions of the American Fisheries Society, Vol. 108, p 307-313, 1979. 3 fig, 4 tab, 13 ref.

Descriptors: *Turbidity, *Sediments, Particle sizes, Ponds, *Aquiculture, Fish farming, Fish establishment, *Alum, Gypsum, Ferric sulfate, Minnows, Freshwater fish, Fathead minnows, Clays, Hydrogen ion concentration, Alkalinity, Water quality, Water chemistry, Water management(Applied).

Alum was more effective than ferric sulfate, hydrated lime, or gypsum in removing clay turbidity from laboratory suspensions of clay. A simple alum-requirement test was developed to determine the amount of alum needed to floc clay particles in pond water. Alum applied to seven ponds at rates determined by this test removed 84 to 97% of the turbidity within 48 hours. Alum-requirement values ranged from 10 to 30 mg/liter for 23 samples of pond waters containing clay turbidity. Each mg/liter of alum destroyed approximately 0.5 mg/liter of total alkalinity, and depressed pH. Fathead minnows (Pimephales promelas) were unharmed by 10-30 mg/liter alum if the total alkalinity was initially above 20 mg/liter, and were unharmed by floc resulting from alum treatment. In waters with total alkalinity below 20 mg/liter, hydrated lime or agricultural limestone may be applied to prevent severe depression of alkalinity and pH that would otherwise be caused by alum. (Katz-EIS)
W79-10214

DETERMINATION OF TOTAL AMMONIA NITROGEN AND CHEMICAL OXYGEN DEMAND IN FISH CULTURE SYSTEMS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquaculture.
C. E. Boyd.
Transactions of the American Fisheries Society, Vol. 108, p 314-319, 1979. 3 fig, 3 tab, 11 ref

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Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

Descriptors: *Water pollution sources, Methodology, Chemical analysis, Water quality, *Aquiculture, Nitrogen compounds, *Ammonia, Total ammonia, Nitrogen, *Fish hatchery, Monitoring, Chemical oxygen demand, Laboratory tests, Fish establishment, Fish farming, Toxicity.

Total ammonia nitrogen (TAN) was measured by the phenate method on filtered and distilled portions of samples from waters used for intensive fish culture. There was a high correlation between TAN values for filtered and distilled portions of samples. The average percentage recovery of 0.30 mg/liter additional of total ammonia nitrogen to samples was 96.4% for distilled portions and 96.7% for filtered portions. Precision of the two versions of the phenate method did not differ. A simple heat-of-dilution chemical oxygen demand (COD) technique was developed which yielded values highly correlated with standard COD values. The heat-of-dilution technique was as precise as the standard COD method, but did not oxidize organic matter as completely. COD values by the heat-of-dilution method averaged 60.2% of standard COD values. (Katz-EIS)
W79-10215

BEHAVIORAL RESPONSES OF SHINER PERCH TO CHLORINATED PRIMARY SEWAGE EFFLUENT,
Washington Univ., Seattle. Fisheries Research Inst.
P. A. Dinnel, Q. J. Stober, and D. H. Di Julio.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 708-714, 1979. 2 fig, 1 tab, 12 ref.

Descriptors: *Fish behavior, *Sewage effluents, *Shiners, Toxicity, Primary treatment, Chlorination, Waste water treatment, Water pollution effects, Water chemistry, Fish populations.

The impact of chlorinated sewage effluent on fish and many invertebrates is difficult to assess because of the behavioral component involved, that is, is the organism attracted or repelled by the effluent plume. The object of this study was to determine the behavioral responses of a locally common marine fish (Cymatogaster aggregata) to chlorinated primary sewage effluent in seawater. Aquaria tests showed that shiner perch avoided levels of chlorinated sewage which would have been lethal to them in 96h. However, they were attracted to lower effluent concentrations which have been shown to produce sublethal damage. Possible mechanisms for this attraction are discussed. (Deal-EIS)
W79-10221

TAURINE AND GLYCINE IN THE GILLS OF THE CLAM PROTOTHACA STAMINEA EXPOSED TO CHLORINATED SEAWATER,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
G. Roesijadi.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 543-547, 1979. 2 tab, 6 ref.

Descriptors: *Amino acids, *Chlorination, *Clams, Animal physiology, Biochemistry, Chemical analysis, Sea water, Animal metabolism, Toxicity, Water chemistry, *Tissue analysis.

The levels of free amino acids in the tissue of molluscs have been reported to fluctuate as a function of environmental stress. In the present study, individuals of the clam Protothaca staminea were exposed to chlorinated seawater for 26 days and the free amino acid levels of the gill tissue were measured. The results of the present study demonstrated an alteration in the free glycine content in the gills. Taurine and total free amino acid concentrations and taurine:glycine ratios, however, were not found to be significantly different when 26 da control values were compared to values for exposed clams sampled at the same time. (Deal-EIS)
W79-10222

AN ASSESSMENT OF THE IMPORTANCE OF TEMPERATURE AS A FACTOR CONTROLLING THE GROWTH RATE OF BROWN TROUT IN STREAMS,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
R. W. Edwards, J. W. Densem, and P. A. Russell.
Journal of Animal Ecology, Vol. 48, p 501-507, 1979. 2 fig, 2 tab, 19 ref.

Descriptors: *Growth rates, *Brown trout, *Water temperature, Mathematical models, Streams, Fish physiology, Water chemistry, Weight, Size, Fish populations, Chalk streams.

The maximum growth rates of brown trout have been computed from temperatures in rivers and streams of contrasting character and location, using a growth model for trout on maximum ration. The high growth rates of trout in chalk streams may be largely explained by their ambient temperature regime, principally its relatively homothermous character. Comparisons of observed and computed maximum growth rates, for the few locations where contemporaneous temperature and growth data are available, suggest that growth rates are generally between 60 and 90% of the computed maximum for that temperature regime and that this percentage is no higher in chalk streams. (Deal-EIS)
W79-10225

BIOASSAY OF BALTIMORE HARBOR SEDIMENTS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
C-F. Tsai, J. Welch, K-Y. Chang, J Shaeffer, and L. E. Cronin.
Estuaries, Vol. 2, No. 3, p 141-153, 1979. 10 fig, 3 tab, 22 ref.

Descriptors: *Bioassay, *Bottom sediments, *Toxicity, Heavy metals, Chesapeake Bay, *Lead, *Chromium, *Zinc, *Cadmium, *Polychlorinated biphenyls, Mortality, Clams, Benthic fauna, Biological communities, Suspended solids, *Arsenic, Mummichog, Spot, Species diversity

Baltimore Harbor, a tributary area of the northern Chesapeake Bay, has received and is receiving large quantities of chemical pollutants. Gross bioassay analyses were performed for sediments from nine representative stations, employing two species of fish, mummichogs (Fundulus heteroclitus) and spot (Leiostomus zanthurus), and one mollusc, the soft-shell clam (Mya arenaria). Acclimated organisms were exposed in static systems to a series of concentrations of suspended sediment from each station, to fuller's earth in suspension, and in control tanks for 48 hours. Parallel analysis of the sediment was performed for the metals, Pb, Cr, Zn, Cd, As, for PCB's and for hexane extracts. The sediments were all substantially polluted with low correlations among components. Twenty-four TLm and 48-hour TLm increased proportionately with sediment concentration but display species specificity. The relationships observed permit use of mummichog data to index gross toxicity of sediments throughout the harbor. Further comparison of mummichog 24-hour TLm value with benthic species diversity determined in a previous study permitted zoning of the entire harbor into highly toxic, moderately toxic, low toxic and slightly toxic zones. Gross toxicity of sediments determined by bioassay can therefore be used as an index of the suitability of the sediments for benthic macroinvertebrate communities. (Deal-EIS)
W79-10227

THE DETECTION OF MUTAGENIC CHEMICALS IN THE TISSUE OF THE MUSSEL MYTILUS EDULIS,
University Coll. of Swansea (Wales). Dept. of Genetics.
J. M. Parry, and M. A. J. Al-Mossawi.
Environmental Pollution, Vol. 13, p 175-186, 1979. 1 fig, 8 tab, 5 ref.

Descriptors: *Genetics, *Mussels, Chemical properties, E coli, Amino acids, Bacteria, Yeasts, Chemical analysis, Animal physiology, Biochemistry, Methodology, *Mutagens, *Tissue analysis.

Alcoholic extracts of the tissues of mussels collected from a number of sites were shown to contain chemicals capable of inducing mutation in bacteria and mitotic gene conversion in yeast. For samples derived from one of the genetically positive sites it was demonstrated that the active chemical is predominantly a frameshift mutagen and that the detectable activity was concentrated in the mantle tissue. (Deal-EIS)
W79-10228

THE DISTRIBUTION AND ABUNDANCE OF NEOMYSIS MERCEDIS IN RELATION TO THE ENTRAPMENT ZONE IN THE WESTERN SACRAMENTO-SAN JOAQUIN DELTA,
California Univ., Davis. Hydrobiology Lab.
C. A. Siegfried, M. C. Kopache, and A. W. Knight.
Transactions of the American Fisheries Society, Vol. 108, p 293-298, 1979. 5 fig, 27 ref.

Descriptors: California, *Sacramento River, San Joaquin Delta, Estuary, *Zooplankton, *Crustaceans, Mysids, Neomysis, *San Francisco Bay, Sampling, Current(Water), Flow, Flow rate, Salinity, Hydraulics, Animal populations, Reproduction, Juvenile stages.

The distribution and abundance of the opossum shrimp, Neomysis mercedis, was studied in a portion of the upper San Francisco Bay estuary in 1976, the fourth-driest year on record. For much of 1976 the entrapment zone, an area of zero net horizontal flow, was located in the study area. Variations in the annual abundance of N. mercedis can be related to the location of the entrapment zone. Juvenile mysids (about 3 mm long) tend to be higher in the water column during daylight than do mature mysids (about 7 mm long) leading to a geographic separation of these life stages. Estuarine hydraulics rather than salinity tolerance determines the distribution of N. mercedis in the study area. (Katz-EIS)
W79-10229

GROWTH RATES OF JUVENILE MAOMAO, ABUDEFDUF ABSOMINALIS, AT CONSTANT AND CYCLIC TEMPERATURES,
Hawaii Inst. of Marine Biology, Honolulu.
P. A. Medvick.
Transactions of the American Fisheries Society, Vol. 108, p 293-298, 1979. 1 fig, 29 ref.

Descriptors: *Water temperature, *Thermal stress, Juvenile fish, Marine fish, Commercial fish, Laboratory tests, Bioassays, Fish food, *Aquiculture, Preferred temperature, Growth rates, Cyclic temperatures, Maomao.

Growth rate and growth efficiency of juvenile maomao are related to temperature. Isolated fish were grown at six temperature regimes (constant: 23.4, 26.4, 29.4, 32.4 C; daily cyclic: 23.4-29.4 C, 26.4-32.4C) and at three food rations. Growth rates (wet weight) of fish fed ad libitum were greatest at the two highest constant temperatures which are near the species' preferred temperature of 30.1 C. At two lower rations fastest growth occurred at 26.4C. Growth rates in cyclic temperatures were not significantly different from those at constant temperatures equivalent to the mean temperature of the cycle. Maomao fed limited rations at cyclic temperatures which bracketed the preferred temperature grew at rates near the maximum for limited rations, indicating little, if any, energy penalty for living at cyclic temperatures. (Katz-EIS)
W79-10230

STUDIES OF HERBICIDE TOXICITY IN SOME FRESHWATER FISHES AND ECTOPROCTA,
Vikram Univ., Ujjain (India). School of Studies in Zoology.
K. S. Rao, and N. K. Dad.
Journal of Fish Biology, Vol. 14, p 523-527, 1979. 4 tab, 25 ref.

Descriptors: *Pesticide toxicity, *Freshwater fishes, *Herbicides, Fish physiology, Chlorinated hydrocarbon pesticides, Dalapon, 2,4-D, Mortality,

Organophosphorus pesticides, Dieldrin, Chemical properties, *Tafazine, *Blades, *Aresin, Bioassay.

The results of studies on herbicides toxicity to fish and freshwater Ectoprocta are reported. The effects of herbicides, viz, Tafazine, Bladex, Aresin and Dalapon were studied on Sarotherodon mossambicus, Puntius ticto, Cirrhinus mrigala, Danio sps., Heteropneustes fossilis, and Channa punctatus, S. mossambicus was more susceptible to Tafazine toxicity. Danio sps. was more resistant to Tafazine than S. mossambicus, but P. ticto had the maximum tolerance. S. mossambicus had greater resistance to Bladex than C. mrigala. C. punctatus was resistant to Aresin toxicity. Herbicide toxicity to freshwater Ectoprocta was noted with reference to Planavin, Bladex, Tafazine, and 2,4-D butyl ester and mixtures of Planavin + Mercuric chloride and Planavin + Bladex. Herbicide toxicity effected the leptoblasts of Plumatella casmiana and spinoblasts of Lophopodella carteri. (Deal-EIS)
W79-10231

THE RATE OF COLONIZATION BY MACRO-INVERTEBRATES ON ARTIFICIAL SUBSTRATE SAMPLERS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
P. G. Meier, D. L. Penrose, and L. Polak.
Freshwater Biology, Vol. 9, p 381-392, 1979. 4 fig, 2 tab, 23 ref.

Descriptors: *Sampling, *Research equipment, *Aquatic insects, Monitoring, On-site data collections, Invertebrates, Biological communities, Detritus, Periphyton, Insects, Diptera, Growth stages, *Species diversity.

The influence of exposure time upon macro-invertebrate colonization on modified Hester-Dendy substrate samplers was investigated over a 60-day period. The duration of exposure affected the number of individuals, taxa and community diversity. The numbers of individuals colonizing the samplers reached a maximum after 39 days and then began to decrease, due to the emergence of adult insects. Coefficients of variation for the four replicate samples retrieved each sampling day fluctuated extensively throughout the study. No tendencies toward increasing or decreasing coefficients of variation were noted with increasing time of sampler exposure. The number of taxa colonizing the samplers increased throughout the study period. The community diversity index was calculated for each sampling day and this function tended to increase throughout the same period. This supports the hypothesis that an exposure period of 6 weeks, as recommended by the United States Environmental Protection Agency, may not always provide adequate opportunity for a truly representative community of macro-invertebrates to colonize multiplate samplers. (Deal-EIS)
W79-10232

GASTRIC EVACUATION IN PLAICE, PLEURONECTES PLATESSA L.: EFFECTS OF TEMPERATURE AND MEAL SIZE,
Glasgow Univ. (Scotland). Dept. of Zoology.
M. Jobling, and P. S. Davies.
Journal of Fish Biology, Vol. 14, p 539-546, 1979. 4 fig, 2 tab, 27 ref.

Descriptors: *Fish physiology, *Water temperature, Digestion, Fish diets, Food habits, Fish farming, Enzymes, Chemical analysis, Animal metabolism, Mathematical studies, *Plaice.

The pattern of gastric evacuation in the plaice can be described by a single curve of curvilinear form, relating the amount of food remaining in the stomach and the post-prandial time. This curve can be transformed to linear form, conforming to a volume dependent model of evacuation. This allows the calculation of the time for complete evacuation of the stomach. The shape of the gastric evacuation curve is unchanged by the size of the meal fed. With increase in temperature however, the form of the curve does change, resulting in shorter times for complete evacuation. (Deal-EIS)
W79-10234

PREDICTION OF POLLUTANT RELEASE RESULTING FROM DREDGING,
Army Engineer District, New Orleans, LA.
C. Grimwood, and T. J. McGhee.
Journal of the Water Pollution Control Federation, Vol. 51, No. 7, p 1811-1815, July 1979. 2 fig, 1 tab, 11 ref.

Descriptors: *Dredging, *Pollutants, *Sampling, *Chemical analysis, Water pollution, Water pollution sources, Coasts, Nitrogen, Chemical oxygen demand, Arsenic compounds, Cadmium, Copper, Chromium, Lead, Mercury, Nickel, Zinc, Phenols, Chemicals, Effluents, Data processing, Analytical techniques.

The standard elutriate test was used to simulate the quality of the effluent during dredging operations and is generally reasonably accurate. In this paper, data collected at 5 southern Louisiana locations were analyzed to assess the predictive value of the test as a tool for estimating pollutant release. The Kolmogorov-Smirnov two-sample test was used to test the correspondence of pollutant release in the dredge effluent and standard elutriate test for total Kjeldahl nitrogen, chemical oxygen demand, cyanide, arsenic, cadmium, copper, chromium, lead, mercury, nickel, zinc, and phenol. It was found that for chemical oxygen demand, chromium, cadmium, and phenol--and to a lesser degree for total Kjeldahl nitrogen, arsenic, nickel, and zinc--the test afforded a useful prediction of release. The relative failure of the test with respect to lead, mercury, and a copper was a result, in part, of adsorption of these materials by the suspended sediment. (Sims-ISWS)
W79-10256

SURFACE TENSION OF A POLLUTED RIVER WATER,
National Inst. for Environmental Studies, Yatabe (Japan).
Y. Ambe.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewardte Limnologie, Vol. 20, Part 3, p 1934-1940, 1978. 9 fig, 1 tab, 11 ref.

Descriptors: Metals, *Copper, *Lead, *Chromium, *Nickel, *Cadmium, Detergents, *Surface tension, Surfactants, Japan, River Tamagawa, Foaming, *Foam fractionation, Foam separation, Water pollution effects.

A change of surface tension of the River Tamagawa was caused by wastes. The middle and lower parts of the river receive the pollution from a population of 1.5 million. The surface tension of the polluted water was measured in the laboratory. The surface tension of the river water decreased as the content of the methylene blue active substances increased. The foaming property of the water was correlated to surface tension. The foam was enriched with particulate matter and the foam concentrated dissolved organic carbon substances and heavy metals. Heavy metals collected in the foam were copper, lead, chromium, nickel and cadmium. (Katz-EIS)
W79-10269

CHANGES IN THE AMOUNT OF ORGANOCHLORINE PESTICIDES IN MACROINVERTEBRATE COMMUNITIES OF THE VAL PARMA RUNNING WATERS (ITALY),
Parma Univ. (Italy). Lab. di Ecologia.
P. F. Ghetti, G. Campanini, and J. Gorbi.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewardte Limnologie, Vol. 20, Part 3, p 1976-1987, 1978. 4 fig, 4 tab, 34 ref.

Descriptors: Benthos, Water pollution effects, Water pollution sources, Lipids, Chemical analysis, Benthos, Macroinvertebrates, Monitoring, *DDT, DDD, DDE, *Dieldrin, *Heptachlor, Aquatic insects, Oligochaetes, Val Parma, Italy, Insecticides, Chlorinated hydrocarbon pesticides, *Aldrin.

The analysis of macroinvertebrates is useful in determining which types of organochlorine products are used in the drainage basins. The correlation of pesticides to the lipid contents of organisms is of value. The determination of organochlorine products in animal tissues can be standardized as a monitoring procedure. Studies were made in four watersheds of the Val Parma, Italy. Chlorinated hydrocarbon pesticides were found in all samples. Benzene, hexachloride, heptachlor, aldrin, dieldrin, DDT, DDD, and DDE were found in the macroinvertebrates. (Katz-EIS)
W79-10270

EFFECTS OF EFFLUENTS FROM A VARIETY OF SEWAGE TREATMENT METHODS ON PRIMARY PRODUCTIVITY, RESPIRATION AND ALGAL COMMUNITIES IN ARTIFICIAL STREAM CHANNELS,
Norsk Inst. for Vannforskning, Blindern.
T. S. Traaen.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewardte Limnologie, Vol. 20, Part 3, p 1767-1771, 1978. 3 fig, 5 ref.

Descriptors: Benthos, Benthic algae, *Eutrophication, *Sewage effluents, Sewage disposal, Sewage treatment, Nutrients, Phosphorus, Laboratory experiments, Methodology, Water pollution sources, Water pollution effects, *Primary productivity, Benthic community, Phosphorus removal, Artificial stream channels.

Experiments were conducted in experimental channels to evaluate the biological effects of effluents from several sewage treatment methods including chemical treatment, combined biological and chemical treatments and pure phosphate additions. Benthic communities in the experimental channels were sensitive to small effluent loads. The primary productivity and community respiration responded markedly to effluent loading. The effluent loads caused qualitative changes in the benthic biota. Different biotic communities were typical of different loading levels. Efficient phosphorus removal reduced the eutrophication symptoms. (Katz-EIS)
W79-10271

SUCCESSION OF PHYTO- AND ZOOPLANKTON IN A WASTEWATER STORAGE RESERVOIR,
Mekorot Water Co., Tel Aviv (Israel).
J. Eren.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1976-1979, 1978. 3 tab, 5 ref.

Descriptors: Waste water, Sewage treatment, *Secondary treatment, Reservoir, Water supply, Algae, *Phytoplankton, Chlamydomonas, *Zooplankton, *Daphnia, Brachionus, Kfar Hasidim Reservoir, Cladocera, Nutrients, Eutrophication, Israel.

Storage of secondary treated wastewater in an open reservoir can provide clean water for summer irrigation. After initial development of dense population of Chlamydomonas and Euglena, there was decline in algal density. During the irrigation season the algal biomass was 1-2 mg (dry weight) per liter, mostly Ankistrodesmus. Herbivorous zooplankton consisted mainly of Daphnia and Brachionus. Toward end of the summer there was a decrease in zooplankton followed by a secondary algal bloom dominated first by Euglena and later by Spirulina. During the entire storage period the reservoir contained dissolved oxygen and no odor or other nuisances were reported. (Katz-EIS)
W79-10272

PHENOMENOLOGY AND MODELLING OF HEAVY METAL DISTRIBUTION IN LAKES,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaessersehutz, Kastienbaum (Switzerland).
P. Baccini, H. Hohl, and T. Bundi.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewardte Limnologie, Vol 20, Part 3, p 1971-1975, 1978. 4 tab, 15 ref.

Descriptors: Metals, *Copper, *Zinc, *Cadmium, *Lead, Ligands, Allochthonous matter, Buffer, Lakes, Lake water, Buffering, Path of pollutants, Algae, Phytoplankton, Model studies, Thermodynamic behaviour.

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The sedimentation of trace metals, Cu, Zn, Cd and Pb is dominated by allochthonous particles. The biogenic particularization is partially reversed by lake internal decomposition processes. In the Lake of Alpnach and the Lake of Biel a model study predicts that an increase of the total metal concentration by a factor of 3 increases the copper content of the plankton by a factor of four. Neither the particulate allochthonous matter nor the dissolved ligands are able to buffer sufficiently the addition of inorganic copper. (Katz-EIS)
W79-10273

PONTOPOREIA DISTRIBUTION ALONG THE KEWEENAW SHORE OF LAKE SUPERIOR AFFECTED BY COPPER TAILINGS),
Michigan Technological Univ., Houghton, MI. Dept. of Biological Sciences.
K. J. Kraft.
Journal of Great Lakes Research, Vol. 5, p 28-35, 1979. 5 fig, 3 tab, 27 ref.

Descriptors: *Copper, Metals, *Lake Superior, Keweenaw Waterway, Water pollution sources, Water pollution effects, Sediment, Benthos, Crustaceans, Amphipoda, *Pontoporeia, On-site-investigation, *Copper tailings, Mining, Mining wastes, Nutrients, Animal populations.

The sediment and benthic macroinvertebrates of a 540 sq km area of Lake Superior were examined. The amphipod Pontoporeia hoyi was by far the most abundant animal collected. A 42 sq km area devoid of P. hoyi was found near where 50 million tons of copper tailings containing metallic copper in concentrations averaging 3750 mg/kg had been dumped between 1895 and 1968. In the no-amphipod region sediment copper ranged from 395 to 1310 mg/kg, while elsewhere mean levels were 14 to 298 mg/kg. The study area was divided into five transects which had maximum densities of P. hoyi ranging from 470 to 4480 sq m. The depth of maximum density ranged from 40-45 to 60-65 m. Maximum density was associated with a mean grain size of phi 3.5-4.0 and elevated levels of total volatile solids, nitrogen, phosphorus, and chemical oxygen demand. Copper and dark color, characteristics of the copper tailings, showed significant negative correlations with P. hoyi density. (Katz-EIS)
W79-10274

PHYTOPLANKTON POPULATION DYNAMICS AND PRODUCTIVITY IN A SEWAGE-ENRICHED TIDAL CREEK IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. G. Sanders, and E. J. Kuenzler.
Estuaries, Vol. 2, p 87-96, 1979. 9 fig, 3 tab, 31 ref.

Descriptors: *Phytoplankton, *Eutrophication, *Nutrients, *Sewage, Sewage effluents, Plant populations, Calico Creek, Salt marsh, Spartina marsh, Tidal marshes, On-site-investigation, Algae, Chlorophyll, Salinity, Hydrogen ion concentration, Dissolved oxygen, Tides, Tidal marshes.

Calico Creek differs from neighboring estuaries in that it receives sewage effluent, and its waters therefore contain ample nutrients. High nutrient levels enable the phytoplankton population, which is probably light-limited, to reach densities of a thousand billion cells/l during the summer, 2 to 3 orders of magnitude higher than the surrounding, nutrient-limited populations. At cell densities greater than 10 million cells/l the number of dominant species is greatly reduced, and the level of diversity drops sharply. Calico Creek also differs by being very shallow; the population can be drastically affected by high runoff. The productivity of both the phytoplankton and the surrounding Spartina marsh is much higher than the neighboring unpolluted estuaries. Unlike the larger and more stable estuaries nearby, the dependence of the population on the effluent for nutrients, the possibility of toxic materials entering the creek with the effluent, and its small size make Calico Creek subject to sudden change. (Katz-EIS)
W79-10275

INHIBITION OF ESTUARINE BACTERIA BY METAL REFINERY EFFLUENT,
Hull Univ. (England). Dept. of Plant Biology.
R. Goulder, A. S. Blanchard, P. J. Metcalf, and B. Wright.
Marine Pollution Bulletin, Vol. 10, p 170-173, 1979. 2 fig, 1 tab, 15 ref.

Descriptors: Metals, *Copper, *Arsenic, *Hydrogen, *Ion concentration, Bacteria, *Toxicity, Inhibition, Laboratory tests, Metal refinery effluent, Industrial wastes, England, Humber estuary, Bacterial activity, Acid water, *Cadmium, *Lead, *Zinc.

Water samples from the Humber Estuary adjacent to a discharge of metal refinery effluent were found to have high dissolved metal concentrations and low pH. Bacterial activities and concentrations of viable bacteria were low, indicating inhibition of bacteria and reduction in self-purification. Toxicity tests demonstrated that acid conditions and copper and arsenic amongst metals probably contributed to bacterial inhibition. Cadmium, lead and zinc were also present. (Katz-EIS)
W79-10277

SEXUAL MATURATION AS A SOURCE OF VARIATION IN THE RELATIONSHIP BETWEEN CADMIUM CONCENTRATION AND BODY WEIGHT OF MYTILUS EDULIS L.,
Institut National de la Recherche Scientifique, Rimouski (Quebec). Lab. Oceanographique.
D. Cossa, E. Bourget, and J. Piuze.
Marine Pollution Bulletin, Vol. 10, p 174-179, 1979. 2 fig, 1 tab, 7 ref.

Descriptors: *Cadmium, Metals, *Mussels, Mytilus, *Monitoring, Indicator species, Animal physiology, Gulf of St Lawrence, Chemical analysis, Tissue concentration, Juvenile growth stage, Metabolism, On-site-investigation, Water pollution effects, Path of pollutants.

In order to refine the utilization of Mytilus edulis as a pollution indicator species, the relationship between cadmium concentration and mussel body weight was investigated at different sites in the Estuary and Gulf of the St. Lawrence. The data show that the regression coefficients become considerably more variable when animals enter adulthood and that the variations are probably related to biochemical changes occurring during the sexual cycle. A substantial improvement of the applicability of mussels for monitoring marine pollution can be achieved by using only immature animals. This should reduce the influence of metabolism on the metal content of mussels and thereby give a more precise indication of ambiant pollution levels. (Katz-EIS)
W79-10278

THE INFLUENCE OF SALINITY ON GROWTH AND STRUCTURE OF EPIDERMAL PAPILLOMAS OF THE EUROPEAN EEL ANGUILLA ANGUILLA L.,
Hamburg Univ. (Germany, F.R.). Inst fuer Hydrobiologie und Fischereiwissenschaft.
G. Peters, and N. Peters.
Journal of Fish Diseases, Vol. 2, p 13-26, 1979. 7 fig, 2 tab, 18 ref.

Descriptors: *Eels, *Animal diseases, *Fish diseases, *Pathology, *Salinity, *Environmental effects, Anguilla, Water properties, Laboratory tests, Tumours, Cauliflower disease, Histology, Fish physiology, Neoplasms, Electron microscopy, Inhibition, Analytical techniques, Water quality, Fresh water, Biochemistry.

Papillomatosis of the European eel Anguilla anguilla occurs predominantly in waters of low to medium salinity (3-20 ppth). Tumour-bearing eels were kept under laboratory conditions for several weeks in salt concentrations of 8, 15 and 30 ppth. As opposed to those kept in freshwater, the experimental animals showed significant decreases in tumour growth rate. At the same time the tumour tissue underwent a marked redifferentiation, i. e. the originally poorly differentiated neoplastic tissue developed numerous mucous and club cells. The characteristic intercellular spaces of tumorous tissue disappeared with the formation of regular membrane interdigitations between adjacent cells. The nucleus to cytoplasm ratios of the neoplastic cells decreased to one-third of those of the untreated tumour. These changes resulted in a reversion of the neoplastic tissue to a structural condition essentially similar to that of normal epidermis. After a period of 2 to 3 months an adaptation to the altered salinity of the external medium was evident in that the tumorous tissue began to return to its original state. (Katz-EIS)
W79-10279

HYDROBIOLOGICAL AND CHEMICAL RESPONSE TO THE ADDITION OF IRON AND ALUMINUM SALTS, STUDIED IN THREE LUND-TYPE BUTYLRUBBER RESERVOIRS,
Koudekerk a/d Rijn (The Netherlands).
B. A. Bannink, and J. C. van der Vlugt.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, part 3, p 1816-1821, 1978. 5 fig, 14 ref

Descriptors: Chlorophyll, *Phytoplankton, Water quality, Water analysis, *Iron, *Iron compounds, *Aluminum, Dodrecht, The Netherland, The Rhine River, Water chemistry, Water management(Applied), Water pollution effects, Water pollution treatment, Water purification, Water storage, Water supply, Water treatment.

On the basis of field experiments in the storage reservoir 'Grote Rug' near Dovdrecht, it was concluded that adding iron was a feasible and effective method of controlling algal biomass and thus maintaining an acceptable water quality in reservoirs which were fed by the River Rhine. The parameters measured in the experimental aquaria were chlorophyll and phosphorus. Changes observed as the result of various chemical treatment of iron were measured. (Katz-EIS)
W79-10280

LIMNOLOGICAL OBSERVATIONS ON A RECENTLY DREDGED POND (GRAVEL-PIT),
Baden-Wuerttemberg Landesanstalt fuer Umweltschutz (Germany, F.R.).
M. W Banoub.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1844-1849, 1978. 5 fig, 1 tab, 2 ref

Descriptors: *Ponds, *Water quality, Chlorophyll, *Primary productivity, Carbon, Particulate organic carbon, Chlorophyll maximum, Water temperature, Alkaline, Silicates, Carbon dioxide, Nitrates, Nitrites, Ammonium, Compounds, Dredging, Aquifers, *Phytoplankton.

A newly dredged pond was studied for the natural developments as well as the effect on surrounding aquifers. Measured were changes in water temperature, alkalinity, carbon dioxide, silicates, calcium, nitrates, nitrites, and ammonium. The annual cycles of chlorophyll, particulate organic carbon primary productivity and heterotrophic activities were measured. The pond in its present state is meso- to eutrophic. (Katz-EIS)
W79-10281

SOME ECOLOGICAL LIMITS OF TOLERANCE OF OCHROMONAS SOCIABILIS,
Konstanz Univ (Germany, F.R.). Dept of Biology.
R Bretthauer.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1850-1854, 1978. 3 fig, 1 tab, 12 ref

Descriptors: Algae, *Phytoplankton, Flagellates, Ochromonas, *Nutrients, *Ammonium compounds, Nitrogen, Nitrate, *Nitrogen compounds, Water temperature, Water pollution effects, Bioassays, Laboratory tests, Ecological limits, Hydrogen ion concentration, Dissolved oxygen, Water quality.

The ecological limits of tolerance of Ochromonas sociabilis to ammonium, nitrite and nitrate and the

optimum values have been analyzed in laboratory experiments. Optimum temperature was about 30 degrees C. Without the addition of ammonia the population growth is limited, 50-100 mg NO3-N/l accelerated the growth of Ochromonas, and 5 mg NO2-N/l intensified population growth. (Katz-EIS)
W79-10283

DEVELOPMENT OF PLANKTONIC ALGAE IN THE RUHR RIVER DEPENDENT ON NUTRIENT SUPPLY, WATERFLOW, IRRADIANCE AND TEMPERATURE,
Ruhr River Association, Essen (Germany, F.R.). Chemical and Biological Lab.
E. A. Nusch.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1837-1843, 1978. 9 fig, 7 ref.

Descriptors: *Phytoplankton, Algae, Ruhr River, *Nutrients, Bioassays, Water quality, Meteorologic data, Hydrologic data, Water chemistry, *Phosphates, Biomass, Primary productivity, Water temperature retention, Water pollution effects, Water pollution sources, Laboratory tests, Scenedesmus, Nitrates, Chlorophyll, *Nitrates.

It is demonstrated that algal growth, especially the mass development of planctonic algae in the Ruhr River is still dependent on nutrient supply. Even if the phosphate concentrations exceed by far the limits to achieve maximum growth rate the maximum yield of algal biomass is determined by the nutrient supply if other influential parameters, e.g. low water flow (i.e. sufficient retention time), irradiance and water temperature, are favourable. The actual N:P ratio in Ruhr River water is near the optimum for algal growth. At high phosphate levels nitrate has a nutritional effect. To abate excessive algal growth in Ruhr River water or to prevent at least the frequent occurrence of water blooms it is necessary to reduce the phosphate concentrations considerably below 0.5 mg/l PO4 3. (Katz-EIS)
W79-10284

SAPROBIOLOGICAL EVALUATION OF DUTCH DITCHES USING BENTHIC ALGAE ON ARTIFICIAL SUBSTRATES,
Water Board of the Rhine District, Leiden (Netherlands).
S. P. Klapwijk.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1811-185, 1978. 2 fig, 2 tab, 13 ref.

Descriptors: Phytoplankton, *Periphyton, *Methodology, Algae, Fresh water algae, Substrates, Plant communities, Research equipment, Research and development, Algal communities, Environmental effects, Water pollution effects, Water quality, Saprobic system, Ammonium salts, Saprobic index, Artificial substrates.

Artificial substrates are valid ecological methods for collecting algae in Saprobiological research. Artificial substrates eliminate difference in substrate preference, eliminate difference in the age of sampled algal communities, allow good observation and quantification, allow the integration of chemical and biological interaction between the environment and the algae. The saprobic system is less applicable to stagnant waters than for running waters and is more suitable for planktonic than for benthic algae. (Katz-EIS)
W79-10285

ORGANISM-SUBSTRATE RELATIONSHIP IN A SMALL DUTCH LOWLAND STREAM. PRELIMINARY RESULTS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Nature Conservation.
H. H. Tolkamp, and J. C. Both.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie. Vol. 20, Part 3, p 1509-1515, 1978. 1 fig, 3 tab, 23 ref.

Descriptors: *Invertebrates, *Benthos, Sampling, Streams, *Substrates, *Sediments, Sands, Litter, Oligochaetes, Crustaceans, Aquatic insects, Water pollution effects, Methodology, Leaves.

An intensive sampling program of the benthos of the Snijdersveerbeek in relation to the substrate was made. Fauna associated with bare sand is poor in individuals although there are some species that prefer this habitat. Leaves support a rich community of species and some species are restricted to this habitat. Different substrates are preferred by different taxa. The influence of life-stage or the microdistribution of macro-invertebrates has been reported. (Katz-EIS)
W79-10289

EFFECTS OF SELFPURIFICATION AND THE BENTHIC ORGANIC LOAD ALONG A STREAM POLLUTED BY A PIGGERY, (IN FRENCH),
Centre Universitaire de Chambery (France).
D. Fontvieille.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1789-1795, 1978. 2 fig, 1 tab, 32 ref (English summary).

Descriptors: *Water pollution effects, Water pollution sources, Streams, Sediments, Organic loading, *Organic wastes, *Piggery, *Self-purification, Biomass, Primary productivity, Benthic load, Macroinvertebrates, Bacteria, Benthic biomass, Animal wastes.

The mean organic loads in the water and the sediment of a brook polluted by pigsty wastes are compared from the point of contamination down to that of nearly complete recovery. Between these two points, the per cent kilometric decrease in organic load is similar for both media. The input of 300 times the benthic energetic load magnifies 3 times the biomass in the upper stations. The ratio of the biomass to the total benthic load is greatest after the water has flowed for 3.30 h. The respired energy to total benthic load ratio continually increases during the 5.30 h drainage time. The efficiency of the self purification also reaches its maximum in the last station downstream. (Katz-EIS)
W79-10290

MINERAL AND PURINIC BIOACCUMULATION IN AQUATIC INSECTS,
Laboratoire d'Histophysiologie des Insetes Paris (France).
D. Lhonore.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 4, p 2652-2655, 1978. 2 tab, 7 ref.

Descriptors: *Aquatic insects, Benthos, Chemical analysis, Spectrophotometry, Calcium, Magnesium, Manganese, *Iron, Phosphorous, Potassium, *Zinc, Chloride, Tissue content, France, Path of pollutants.

The use of cytochemical and x-ray spectography allows the location and chemical identification of mineral and purinic concentration in tissues of aquatic insects. The most common elements in insect larvae from unpolluted streams are calcium, magnesium, manganese, iron, phosphorous and sometimes potassium, zinc and chlorides. These elements are found in the eye, epidermis, fat body, midgut and Malpighian tubules. (Katz-EIS)
W79-10292

INDICATOR COMMUNITIES OF OLIGOCHAETES IN SCANDINAVIAN LAKES,
Uppsala Univ. (Sweden). Inst. of Zoology.
G. Milbrink.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 4, p 2406-2411, 1978. 1 fig, 1 tab, 8 ref.

Descriptors: *Oligochaetes, *Water quality, Nutrients, *Benthos, Freshwater benthos, *Animal grouping, Eutrophication, Oligotrophy, Sweden, Lakes, Mesotrophy, Water pollution effects.

An attempt is made to correlate distribution of various species of oligochaetes in water with different limnological parameters including water pollution. Although some species of oligochaetes are probably tolerant of pollution, there is still not sufficient data before a standardized use of oligochaetes, to evaluate water quality is possible in Swedish water. (Katz-EIS)
W79-10293

EFFECT OF A STEAM ELECTRIC GENERATING STATION ON THE EMERGENCE TIMING OF THE MAYFLY, HEXAGENIA BILINEATA (SAY),
Oak Ridge National Lab., TN.
J. S. Mattice, and L. L. Dye.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1752-1758, 1978. 4 fig, 1 tab, 15 ref.

Descriptors: *Benthos, *Mayflies, Aquatic insects, *Water temperature, *Thermal power, Hexagenia, Animal growth, Animal behavior, Animal physiology, Reproduction, Emergence, Emergence timing, Kingston Steam Plant, Clinch River, Seasonal temperature, Steam electric generating station, Water pollution source.

Laboratory studies indicate that the growth and emergence of Nexagenia occur faster at 25 degrees than 15 degrees. The changes in the timing of emergence correlate well with the hypothesis of temperature causation. The accelerated emergence in the discharge cone of the Kingston Steam Plant is probably not significant for mayfly populations of the whole reservoir and is localized and would not translate to ecosystem changes of predator populations. (Katz-EIS)
W79-10296

A SCANNING ELECTRON MICROSCOPIC STUDY OF PERIPHYTON COLONIZATION IN A SMALL STREAM SUBJECTED TO SODIUM CHLORIDE ADDITION,
Brock Univ., St. Catharines (Ontario). Dept. of Biological Sciences.
M. D. Dickman, and M. B. Gochnauer.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1738-1743, 1978. 3 fig, 5 tab.

Descriptors: *Salinity, *Chlorides, *Freshwater, Water pollution effects, Water pollution sources, Algae, Plant populations, Bacteria, On-site-investigation, Electron microscopy, Benthos, Invertebrate, Algal diversity, Algal density, Fungal parasitism, Invertebrate herbivores, *Periphyton.

The addition of 1,000 ppm sodium chloride to a small stream in order to simulate road salt loading resulted in a reduction in algal density and an increase in bacterial density during a four week exposure period. The scanning electron microscope was used to identify changes in the spatial pattern of periphyton community structure using specially prepared slate substrates which were placed in the stream at the onset of the study. Phytophagous invertebrates increased algal diversity at the control station by preventing the dominant alga, Cocconeis placentula, from crowding out the other algal colonizers. Algal diversity remained lower at the salt stressed station as did algal density, fungal parasitism and invertebrate herbivory throughout the four week experiment. (Katz-EIS)
W79-10297

EFFECTS OF PULP MILL AND MUNICIPAL EFFLUENTS AND HUMUS LOAD ON THE MACRO- AND MEIOZOOBENTHOS OF SOME FINNISH LAKES,
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
L. Paasivirta, and J. Sarkka.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie. Vol 20, Part 3, p 1779-1788, 1978. 6 fig, 2 tab, 21 ref.

Descriptors: *Water pollution effects, Benthos, *Macrobenthos, *Meiozoobenthos, Finland, Kymijok, Water course, Animal populations, Domestic wastes, Sewage, Humus, Water quality, *Pulp and paper industry, Oxygen, Water color, Seasonal

changes, Biomass, Animal communities, Methodology.

The effects of effluents from pulp and paper mills on the macro- and meiozoobenthos in Finnish lakes with different humus contents were studied. The qualitative and quantitative differences between the benthic animal communities of the stations studied support the usefulness of zoobenthos on the assessment of pollution and the humus load of lakes. The varying occurrence of species at the various stations makes it possible to create species groups in relation to ecologically important environmental factors. There are also groups of species that seem to be indifferent to environmental changes. (Katz-EIS)
W79-10298

EFFECT OF AGE, WEIGHT, AND SEX ON THE MERCURY CONTENT IN THE MUSCLES AND SELECTED ORGANS OF NORTHERN PIKE (ESOX LUCIUS L.), (IN POLISH),
Instytut Technologii zym Zywnosci Pochodzenia Morskiego, Szczecin (Poland).
M. Protasowicki, and A. Ociepa.
Zeszyty Naukowe Akademii Rolniczej W Szczecinie, No. 7, p 145-155, 1978. 4 tab, 19 ref. (English Summary).

Descriptors: *Mercury, Metals, Water quality, *Pike, Chemical analysis, Poland, Lake, Dabie, *Tissue concentration, Spectrophotometry, Age, Weight, Sex, Muscle content, Path of pollutants, Esox lucius

Investigations were made of 30 samples of pike from Lake Dabie. Mercury content was determined in muscle, kidney, liver, intestine, spleen, gills and gonads. Determination was done by flameless atomic absorption spectrophotometry using spectrophotometer Coleman MAS-50. It was found that mercury content in muscle and other internal organs do not depend upon sex. However, it was demonstrated that this element level increases with age, weight, and length in muscle, kidney, liver, intestine, spleen, and gills. Average mercury content and confidence limits are the following: muscle - 0.220, kidney - 0.129, liver - 0.082, intestine - 0.057, spleen - 0.055, gills - 0.031, and gonads - 0.013 mg/kg. The mercury content in pike's organs is a result of the natural content of this element in water of Lake Dabie. (Katz-EIS)
W79-10299

PRELIMINARY EXPERIMENTS WITH SEA URCHIN PLUTEUS AND METAMORPHOSIS IN MARINE POLLUTION BIOASSAY,
Doshisha Univ., Kyoto (Japan). Biological Lab.
N. Kobayashi
Publications of the Seto Marine Biological Laboratory, Vol. 24, p 9-21, 1977. 12 fig, 5 tab, 15 ref

Descriptors: *Methodology, *Sea urchin, *Sand dollar, Marine benthos, Bioassay, Toxicity, Juvenile growth stage, Japan, Mercury, Copper, Zinc, Cadmium, Chromium, Detergents, Alkylbenzene, Sulfonate, Ammonia, Arsenic, *Water pollution effects

Effects of some pollutants upon the pluteus formation in the sea urchin, Anthocidaris crassispina, were examined. Effects of some pollutants and polluted sea water upon the developmental stages from fertilization to metamorphosis in the sand dollar, Peronella japonica, were studied. The effects were more pronounced in the pluteus formation than in any other stages prior to it in Anthocidaris and Peronella. Throughout the whole stages from fertilization to pluteus formation, Peronella was seemingly more sensitive than Anthocidaris, the sensitivity was especially remarkable in the metamorphosis of Peronella. All these tendencies were demonstrated again in the tests with the polluted sea water samples from around Hatakejima Island. (Katz-EIS)
W79-10300

CONCENTRATIONS OF PCBS, BHCS AND DDTS RESIDUES IN SEAWEEDS OF THE EAST COAST OF SICILY,
Catania Univ. (Italy). Inst. di Chimica e Chimica Industriale.
V. Amico, G. Oriente, M. Piattelli, and C. Tringali.
Marine Pollution Bulletin, Vol. 10, p 177-179, 1979. 1 fig, 1 tab, 6 ref.

Descriptors: *Polychlorinated biphenyl, *Benzene, Hexachloride, *DDT, *DDE, *Seaweed, Marine algae, Path of pollutants, Pesticides, Insecticides, Chlorinated hydrocarbon pesticides, Sicily, On-site investigation, Chemical analysis, Rhodophyta, Phaeophyta, Clorophyta.

The levels of PCBs, DDT and BHC residues have been determined in thalli of 12 species of marine algae harvested along the east coast of Sicily. The results are discussed in comparison with those obtained earlier with animal species sampled in the same area. A closer comparison between the patterns of chlorinated hydrocarbons in seaweeds and those in mussel (and more loosely in other animal species) discloses some notable differences: (a) the ratio sigma DDT/sigma PCB is consistently lower in algae than in animals, whereas the opposite applies to the ratio sigma DDT/sigma DDE, and (b) the peak patterns of PCB obtained from seaweeds are not comparable in proportions with those from animals and are characterized by higher intensities of peaks of shorter retention time (less chlorinated biphenyls). (Katz-EIS)
W79-10301

EFFECT OF A PUMP-STORAGE HYDROELECTRIC SCHEME ON THE STRATIFICATION AND ECOLOGY OF A SCOTTISH LOCH,
Glasgow Univ. (Scotland). Dept. of Zoology
R. Tippett.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 4, p 2697-2700, 1978. 3 fig, 2 ref

Descriptors: *Phytoplankton, *Zooplankton, Fresh water, On-site investigation, Cladocera, Rotifers, Lakes, *Reservoirs, *Pumped storage, Pumping, Scotland, Cruachan pump-storage scheme, Loch Awe, Algae, Plant grouping, Community diversity, Diversity index

A field study was conducted in 1975 and 1976 on the effects of the Cruachan Pump-Storage scheme on the limnology of Loch Awe in the north of Scotland. Phytoplankton and zooplankton were observed. Phytoplankton community diversity fell rapidly in the spring but steadily increased through the summer to more than 3 by the time stratification had broken down. The zooplankton community diversity appeared to be slightly higher in late spring and summer than other times. (Katz-EIS)
W79-10302

SOME PRELIMINARY DATA ON NUTRIENTS AND CHLOROPHYLL IN ORGANICALLY POLLUTED RIVERS (GRANADA/SOUTH SPAIN),
Granada Univ. (Spain). Dept. of Zoology.
R. Martinez
Verhandlungen Internationale Vereinigung fur Theoretische und ungewardte Limnologie, Vol. 20, Part 4, p 2722-2730, 1978. 7 fig, 6 ref

Descriptors: *Nutrients, *Nitrates, *Phosphates, Chlorophyll, *On-site-investigation, Oxygen, Oxygen demand, Water pollution effects, Algae, Benthos, Bacteria, Industrial wastes, Organic wastes, Organic loading, Olive wastes, Granada, South Spain, Cubillas River, Olive-oil factories

Two small rivers in the province of Granada (South Spain) have been surveyed, one of them showing heavy organic pollution from olive residues coming from olive-oil factories, and the other one being free from it. From December 1975 to May 1977 samples were taken every 20 days and several parameters were estimated, concerned to water chemistry, epilithic chlorophyll and bacterial, algal (diatoms) and bottom fauna populations. Some preliminary data presented referred to nutrients and chlorophyll, which show considerable differences between both rivers. The outstanding characteristic of the polluted stream was the low chlorophyll concentration during the pollution period. Low chlorophyll content was related to low nitrate content. Low oxygen content of the water was also observed. (Katz-EIS)
W79-10303

EFFECT OF HYDROLOGICAL CHANGES ON AQUATIC COMMUNITIES IN THE LOWER JORDAN RIVER,
Hebrew Univ., Jerusalem (Israel). Dept. of Zoology
R. Ortal, and F. D. Por.
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1543-1551, 1978. 4 fig, 2 tab, 5 ref.

Descriptors: Animal groupings, *Animal populations, Streams, Dams, Reservoirs, *Hydrology, Toxicity, Water temperature, Thermal water, Phenol, Benthos, On-site-investigation, *Jordan River, Israel, Water pollution effects, *Nutrients, Phosphates, Nitrogen compound, Formaldehyde

The lower Jordan River, in Israel has undergone extensive changes due to water use. Most natural water is utilized and the remaining water is irrigation return water and wastes including agricultural drainage, fish pond wastes, domestic and industrial wastes. The animal communities of the lower Jordan River were sampled and the chemical and physical parameters were determined. Four factors influenced the lower Jordan River: hydraulics, thermosaline factor, nutrients and toxicity. Toxicity results from phenol and formaldehyde compounds whose influence is restricted to a short segment of the river mainly in the winter. (Katz-EIS)
W79-10304

INFLUENCE OF THE FISHSTOCK ON THE PHOSPHORUS-CHLOROPHYLL RATIO,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
J. Hrbacek, B. Desortova, and J. Popovsky
Verhandlungen Internationale Vereinigung fur Theoretische und ungewandte Limnologie, Vol. 20, Part 3, p 1624-1628, 1978. 2 fig, 2 tab, 15 ref

Descriptors: *Nutrients, *Chlorophyll, Biomass, Primary production, Reservoir, Czechoslovakia, Rainbow trout, Brown trout, Daphnia, Fish management, *Fish populations, Fish harvest, Phytoplankton, Zooplankton, Phosphorous-chlorophyll ratio.

A study was made to determine the influence of fish stocks on the metabolism of reservoir communities. Reservoirs with a low fish stock showed in the course of two years a chlorophyll concentration of half those reservoirs with normal fish stocks. The relative amount of chlorophyll per unit of biomass in ponds with low fish stock was on the average about half the other reservoirs with larger fish stocks. (Katz-EIS)
W79-10305

CHANGES OF PHYTOPLANKTON COMPOSITION AND ITS CHARACTERISTICS DURING RED TIDE SEASON, (IN JAPANESE),
Tokai Regional Fisheries Research Lab., Tokyo (Japan). Water Quality Div.
T. Honjo, T. Shimouse, N. Ueda, and T. Hanaoka.
Bulletin of the Plankton Society of Japan, Vol. 25, p 13-19, 1978. 5 fig, 8 ref. (English Summary)

Descriptors: *Red tide, *Phytoplankton, Nutrients, Plant populations, Marine algae, *Diatoms, *Dinoflagellates, Japan, Hakata Bay, On-site-investigations, Nitrates, Phosphates, *Iron, Manganese, Chelation, Plant growth, Plant growth regulations, Daily changes

An investigation was made during May and June, 1973, in the Hakozaki fishing port, Hakata Bay. Water samples were collected daily from the surface water, and identification of species and counts of the number of cells were carried out. These data were divided into four groups as diatoms, Heterosigma sp., large flagellates, and small flagellates. Heterosigma sp. and large flagellates do not com-

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pete with each other for growth. 2. Propagation of small flagellates declined temporarily with the growth of Heterosigma sp. but those of diatoms (S. costatum, Chaetoceros sp. and Thalassiosira sp) except Nitzschia sp. were inhibited completely during Heterosigma sp. red tide. On the other hand, filtrates (enriched N, P, Si, B12, Fe, Mn, EDTA) through membrane filter (0.45 micron in pore size) of water samples in the period of Heterosigma sp. red tide inhibited the growth of S. costatum but not the growth of N. closterium and Phaeodactylum tricornutum. Enriched filtrate of conditioned medium with Heterosigma sp. which has grown in the laboratory inhibited also the growth of S. costatum. These results obtained from the field and the laboratory suggest that Heterosigma sp. red tide might be able to inhibit growth of some diatoms and simplify the species composition in the water, being affected by an ectocrine which might be released from the red tide cells. (Katz-EIS)
W79-10306

SUITABILITY OF ACTIVATED AH-FILTERED WATER TO STUDY DEVELOPMENT OF SALMONID EMBRYOS, (IN POLISH),
Institute of Icththyology, Szczecin (Poland). Zaklad Anatomii i Embriologii Ryd.
W. Wawrzyniak, and A. Winnicki.
Zeszyty Naukowe Akademii Rolniczeu W Szczecinie, No. 70, p 41-49. 1978. 5 fig, 2 tab, 18 ref. (English Summary).

Descriptors: *Aquiculture, *Rainbow trout, Brown trout, Water quality, *Chlorine, *Activated carbon, Water filter, Carbon dioxide, Filtered water, Fish hatchery, Fish eggs. Fish physiology, Fish reproduction, *Fish pathology, Fish establishment.

Eggs of rainbow trout (Salmo gairdneri Rich.) and trout (Salmo trutta L.) were incubated in flowing water with chlorine removed by using a filter provided with activated carbon. Experiments and observations have shown a much higher occurrence of disturbed development, higher mortality and postponed development (ca 10%) to take place in flowing purified water. In the author's opinion, the facts observed are due to an oxygen deficiency and a higher CO2 content in the filtered water. The filter removes chlorine, suspensions etc., but without an additional treatment of the water, eggs of the species studied cannot be incubated. (Katz-EIS)
W79-10307

CHANGES IN DDT, DDE AND DDD CONTENTS DURING PRODUCTION OF CANNED HERRING (THE 'GDANSK HERRING'), (IN POLISH),
Instytut Technologii zym Zyrnosci Pochodzenia Morskiego, Szczecin (Poland). Zaklad Higieny Przemyslu Rybengo.
W. Ciereszko, D. Bobinska, and A. Chodyniecki.
Zeszyty Naukowe Akademii Rolniczej w Szczecinie, No. 70, p 139-145, 1978. 1 fig, 1 tab, 16 ref. (English summary).

Descriptors: *DDT, *DDE, *DDD, Public health, Water pollution effects, Path of pollutants, Chemical analysis, *Commercial fish, Food processing industry, Foods, Food web, Canned herring, Poland, Gdansk fisheries. Fish harvest.

An effect of each particular stage of canned herring production on DDT and its metabolites, DDE and DDD, contents was studied. The compounds studied were found to be present in every sample taken at each production stage as well as in the aromatised oil. The following contents of DDT, DDE, and DDD, respectively, were revealed in fresh Baltic herring flesh: 0.065, 0.046 and 0.067 mg/kg. No significant influence of salt-vinegar bathing on the contents of the compounds in question was noted, while after the steam treatment, as a result of drip, a total DDT content increased by 57.6% when compared to that in fresh fish. A relatively high DDT level was found in the aromatised oil whereby the final DDT content in a finished product increased to 0.302 mg/kg, i.r., the 78.7% increase was observed in relation to the original level in raw material. Thermal treatment was found to exert no significant effect upon the decrease of the studied compounds contents in fish and aromatised oil. (Katz-EIS)
W79-10308

INDICATOR VALUE OF FRESHWATER OSTRACODA,
Prague Dept. of Water Technology and Environmental Engineering (Czechoslovakia).
V. Sladecek.
Acta Hydrochimica et Hydrobiologica, Vol. 6, p 561-565, 1978. 1 fig, 1 tab, 11 ref.

Descriptors: *Ostracods, *Monitoring, Benthos, Crustaceans, Europe, *Indicators, *Saprobic evaluation, Zooplankton, Water quality, Animal groupings, Animal populations, Dissolved oxygen, Oxygen requirements.

The saprobic evaluation of 35 species of ostracods common to central Europe is given. Ostracods are not present in highly polluted waters and the worst saprobic conditions they tolerate is the alpha-meso-saprobicity. Only a few species are able to survive long periods of oxygen exhaustion on the bottom. (Katz-EIS)
W79-10309

EXPERIMENTAL REARING OF RAINBOW TROUT (SALMO GAIRDNERI RICH.) IN COOLING WATERS OF 'DOLNA ODRA' POWER STATION),
Institute of Marine Biological Resources Exploitation and Protection, Szczecin (Poland).
R. Trzebiatowski, J. Filipiak, R. Jakubowski, and M. Seyda.
Acta Ichthyologica et Piscatoria, Vol. 7, p 32-40, 1977. 4 fig, 1 tab, 7 ref.

Descriptors: *Water temperature, *Aquiculture, *Cooling water, Power plants, Rainbow trout, Poland, Dolna Odra Power Station, *Fish farming, Hydrogen ion concentration, Fish physiology, On-site-investigation, Fish diets, Fish diseases.

The paper contains results of studies on cage rearing of rainbow trout in cooling waters of the 'Dolna Odra' power station. The experiments, concerning the 0+ young rainbow trout, were carried out during 65 days. Fish were fed on a trout pellet the portion given amounting to 3% of the current fish weight. From May through October the culture was run in a power station water-supplying channel. Water temperature in the test channels never exceeded 27 degrees C or fell below 10 degrees C. Water pH ranged within 7.2 - 8.4 except with one two week episode in which the pH exceeded 9.2 due to the addition of alkalizing chemicals. It was concluded that at temperatures lower than 20 degrees C the cooling waters were satisfactory to rear fish. (Katz-EIS)
W79-10310

CONCENTRATION FACTORS OF THE ELEMENTS COBALT, MANGANESE, IRON, ZINC AND SILVER FOR FISH,
Bundesforschunganstalt fuer Fisherei, Hamburg (Germany, F.R.). Istopenlaboratorium.
W. Feldt, and M. Melzer.
Archiv fur Fischerei Wissenschaft, Vol. 29, p 105-112, 1978. 5 fig, 1 tab, 5 ref.

Descriptors: *Cobalt, *Manganese, *Iron, *Zinc, *Silver, Freshwater fish, Chemical analysis, Water quality, Concentration factor, Bioaccumulation factor, Prediction, Fish flesh, Germany, Danube River, Elbe River, Neckar River, Rhine River, Weser River, Rainbow trout, Carp, Cod, Minnows, Commercial fish.

Fish and water were analyzed from different German rivers for the elements cobalt, manganese, iron, zinc and silver. The concentration factor (bioaccumulation factor) for fishflesh is inversely proportional to the element concentration in the unfiltered water. This pattern applied to elements that are homeostatically maintained at a constant concentration in organisms or tissues despite different concentrations of the elements in water. Mathematical equations have been derived from the investigations carried out to predict concentration factors for fishflesh from the knowledge of stable element concentrations in water. (Katz-EIS)
W79-10311

NEW TERMINOLOGY REQUIRED FOR SHORT-TERM STATIC FISH BIOASSAYS: LC(I)50,
Ministry of Agriculture, Fisheries and Food London (England). Salmon and Freshwater Fisheries Lab.
R. Lloyd, and T. E. Tooby.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 1-3, 1979. 4 ref.

Descriptors: *Methodology, *Toxicity, *Bioassay, Laboratory tests, *Monitoring, Chemical analysis, Chemical data, Physical data, Lethal concentration, Data collection, Data storage and retrieval, Chemical wastes, Chemical registration.

A terminology is suggested to express data from static fish bioassay tests in which the concentration of toxicant at the end of the test is decreased by over 10% from that concentration present at the beginning of the experiment. LC(I)50 is proposed. C(I) is derived from the initial concentration of test solutions. This procedure is used to differentiate data from tests in which the toxicant concentration did not decrease. (Katz-EIS)
W79-10312

THE EFFECT OF OSMOTIC STRESS ON THE SURVIVAL AND RESPIRATION OF THE STONEFLY NYMPH, PARAGNETINA MEDIA,
N. N. Kapoor.
Gewasser und Abwasser, Vol. 64, p 37-38, 1979. 3 ref.

Descriptors: *Benthos, *Aquatic insects, Animal physiology, *Salinity, Insect behavior, Insect resistance, Bioassay, Laboratory test, Saline water, Salt tolerance, *Stoneflies, Stonefly larvae, Stonefly nymphs, Paragnetina, Toxicity, Mortality.

Stonefly nymphs were exposed for 72 hours to media containing 0.0, 0.005, 0.01, 0.04, 0.12, 0.20, 0.95, 1.10 and 1.20 sodium chloride. The response of surviving nymphs was determined by observing changes in oxygen consumption and osmotality of urine and hemolymph. Nymphs of Paragnetina showed a good regulation of hemolymph through a media range of 0.12 - 0.95% NaCl. (Katz-EIS)
W79-10313

EFFECTS OF GRANULAR 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73) ON BENTHIC MACROINVERTEBRATES IN A LAKE ENVIRONMENT),
National Fishery Research Lab., LaCrosse, WI.
P. A. Gilderhus.
Great Lakes Fishery Commission, Technical Report No. 34, p 1-5, 1979. 3 tab, 6 ref.

Descriptors: Toxicity, Mortality, *Benthos, Freshwater fish, Larvae, Juvenile growth stages, *Lampreys, Sea lamprey, Petromyzon, *Oligochaetes, Midge larvae, *Aquatic insects, Pesticides, Bayer 73, 2',5-Dichloro-4'-Nitrosalicylanilde, Macroinvertebrates, *Michigan, Boardman Lake, Amphipoda, Mayflies, Fish management, Water pollution sources, Water pollution effects.

Benthic organisms were collected before, and during the first 13 days after, treatment of a selected area of a lake with granular Bayer 73 for control of larval sea lamprey (Petromyzon marinus) to determine the effects of the treatment on invertebrates. Total numbers of organisms in the treated area dropped 56% in the first 7 days after treatment. Most of the reduction occurred among oligochaetes and midge larvae. Numbers of mayfly nymphs and amphipods were not substantially affected. Total numbers of organisms and numbers of oligochaetes and midge larvae increased between 7 and 13 days after treatment. Judging from this study, treatments with Bayer 73 are expected to have only moderate effects of short duration on populations of macroinvertebrates. (Katz-EIS)

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W79-10314

EFFICACY OF ANTIMYCIN FOR CONTROL OF LARVAL SEA LAMPREYS (PETROMYZON MARINUS) IN LENTIC HABITATS,
National Fishery Research Lab., LaCrosse, WI.
P. A. Gilderhus.
Great Lakes Fishery Commission, Technical Report No. 34, p 6-17, 1979. 1 fig, 3 tab, 8 ref.

Descriptors: Freshwater fish, *Toxicity, *Mortality, Bioassay, *Lamprey, Petromyzon, Lakes, Charlevoix Lake, Ocqueoc Lake, Harlow Lake, *Lake Michigan, Lake Huron, Lake Superior, *Antimycin, Juvenile fish, Lake trials, Michigan, Rainbow trout suckers, Brown trout, Bass, Yellow perch, On-site-investigation, Water pollution effects, Water pollution sources.

Antimycin, in a delayed-release granular formulation, was shown to be effective for control of larval sea lampreys (Petromyzon marinus) in lentic habitats at treatment rates of 75 to 150 g of active ingredient per hectare. When the chemical was tested four inland lakes connected to the Great Lakes and known to harbor larval lampreys, about 90% or more of the larval lampreys present were killed by treatments of 150 g/ha (active ingredient). Treatment at 75 g/ha killed more than 90% in warm water but only 66% in cold water. Some small fish, mostly bottom-dwelling forms, were killed by the treatment. (Katz-EIS)
W79-10315

PHYSICAL AND CHEMICAL FACTORS AFFECTING FISH DISTRIBUTION IN LAKE MANZALAH-EGYPT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
S. D. Wahby, and N. F. Bishara.
Acta Ichthyologica et Piscatoria, Vol. 7, p 15-30, 1977. 1 fig, 4 tab, 54 ref.

Descriptors: *Water temperature, *Hydrogen ion concentration, *Dissolved oxygen, Marine fish, Freshwater fish, Brackish water fish, Environment, Environmental gradient, *Lake Manzalah, Egypt, Salinity, Fish populations, Commercial fish, Commercial fisheries, Mullets, Tilapia, Nile Delta, Seasonal distribution.

The fish distribution in Lake Manzalah, the largest of the Delta Lakes of Egypt, was studied and discussed in the light of the prevailing physical and chemical conditions. The lake-sea connection is of vital importance for the welfare of the lake and has a pronounced effect on the fish distribution. Many marine forms like Mugil cephalus, M. capito, Sciaena aquilla, Chrysophris aurata, Morone labrax, M. punctata and shrimps can tolerate the brackish water of the lake during certain phases of their life. Tilapia spp., namely Tilapia aurea, T. galilaea, T. nilotica and T. zillii being the principal fish in the lake have different degrees of salinity tolerance. The tolerate limits of different ecological factors like salinity, temperature, pH and dissolved oxygen was determined for different species of fish. (Katz-EIS)
W79-10316

A RED TIDE OCCURRED AT THE HAKOZAKI FISHING PORT, HAKATA BAY, IN 1973. THE GROWTH PROCESS AND THE CHLOROPHYLL CONTENT,
Tokai Regional Fisheries Research Lab., Tokyo (Japan). Water Quality Div.
T. Honjo, T. Shimouse, and T. Hanaoka.
Bulletin of Plankton Society of Japan, Vol. 25, p 7-12, 1978. 3 fig, 23 ref.

Descriptors: *Phytoplankton, *Chlorophyll, *Red tide, Marine algae, Plant growth, Plant populations, Dinoflagellates, Heterosigma, Water temperature, Salinity, Japan, Hakata Bay.

Red tide consisting of two peaks took place in the Hakozaki fishing port, Hakata Bay, between late May and early June, 1973. A predominant organism was identified temporarily as Heterosigma sp., genus Heterosigma Hada, Dinoflagellida. The maximum cell density and chlorophyll-a concentration recorded at the time of the red tide were 835,000,000 cells/liter and 1,628 micrograms chl-a/liter, respectively. The average chlorophyll-a concentration per one cell was about .00000246 micrograms and growth rate (k'/day) of the red tide was calculated as 0.405. Although non-motile cells, non-flagella and global, were observed during early growth phase of the red tide, it could not be confirmed whether the non-motile cells were a form of early stage of Heterosigma sp. or not. (Katz-EIS)
W79-10317

THE TOXICITY OF A PRESUMPTIVE STEEL WORKS EFFLUENT FORMULATION,
University of Strathclyde, Glasgow (Scotland). Dept. of Biology.
O. J. Abbott, and E. J. Perkins.
Marine Pollution Bulletin, Vol. 10, p 176-177, 1979. 1 fig, 1 tab, 6 ref.

Descriptors: Bioassay, *Toxicity, Sulfur, Waste treatment, Steel, *Steel mill effluents, Industrial wastes, *Shrimps, *Crabs, Starfish, Sea urchins, Sulfides, England.

The toxicity of a steel works effluent to typical marine macro invertebrates was determined by bioassay. The 'Stretford Process' effluent which removes sulfur from the coke oven gas is less toxic to marine life than effluents with a higher sulfur content. (Katz-EIS)
W79-10319

5B. Sources Of Pollution

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME I, FEBRUARY 28-MARCH 3, 1977.
For primary bibliographic entry see Field 2A.
W79-10084

DRAINAGE BASIN RESEARCH IN EASTERN NORTH AMERICA,
National Science Foundation, Washington, DC. Div. of Advanced Environmental Research and Technology.
For primary bibliographic entry see Field 2E.
W79-10085

LAKE JACKSON WATERSHED STUDY: DESCRIPTION OF SITES, METHODOLOGY AND SCOPE OF RESEARCH,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10087

AN OVERVIEW OF THE CHOWAN RIVER RURAL RUNOFF STUDY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W79-10088

WATERSHED RESEARCH IN NOVA SCOTIA,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-10089

THE MAHANTANGO CREEK WATERSHED--AN INTERDISCIPLINARY WATERSHED RESEARCH PROGRAM IN PENNSYLVANIA,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2A.
W79-10090

AN OVERVIEW OF THE RHODE RIVER WATERSHED PROGRAM,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 2A.
W79-10091

NUTRIENT LOADING OF THE RHODE RIVER WATERSHED VIA LAND USE PRACTICE AND PRECIPITATION,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
J. Miklas, T-L. Wu, A. Hiatt, and D. L. Correll.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 169-193, 1977. 2 fig, 5 tab, 4 ref. EPA R804536-01.

Descriptors: *Nutrients, *Watersheds(Basins), *Precipitation(Atmospheric), *Land use, Water pollution, Water pollution sources, Chemistry of precipitation, Fertilizers, Feed lots, Farm wastes, Pastures, Nitrogen, Nitrates, Phosphorus, Potassium, Calcium, Magnesium, Sampling, Chemical analysis, Pollutants, Path of pollutants, *Rhode River Watershed(MD).

Nutrient loadings due to land use practices and precipitation were estimated for 983 ha of Rhode River watershed for 1976 both by land use categories and for 8 basins. Row crops and pasture occupied 38% of the area. Nitrogen loading averaged 24.9 Kg/ha-year from land use practices and 11.5 from precipitation for a total of 36.4. The nitrogen loading due to land use varied from 8.5 Kg/ha-year for basin 103 to 90.3 for basin 109. Loading of nitrogen due to various land uses varied from 7.6 Kg/ha-year for hayfields to 89.2 for corn to 4,490 for hog lots. The nitrogen in precipitation was predominantly in wet fall and about half was present as nitrate. The total yearly load of nitrate increased by 42% from 1974 to 1976. Phosphorus loading due to land use averaged 7.6 Kg P/ha-year and from precipitation was 0.75 for a total of 8.35. Phosphorus loading due to land use varied from 2.4 Kg/ha-year for basin 103 to 25.2 for basin 109. Loadings of phosphorus due to land use varied from 3.3 Kg/ha-year for hayfields to 65.7 for tobacco to 894 for hog lots. The phosphorus in precipitation was primarily dry fall. Potassium loading due to land use practices averaged 69.7 Kg/ha-year, and precipitation yielded 2.9 for a total of 72.6. Loading of potassium due to land use varied from 7.5 Kg/ha-year for basin 103 to 48.8 for basin 109 and from 6.9 Kg/ha-year for hayfields to 188 for tobacco to 876 for hog lots. Loading with calcium due to land use averaged 173 Kg/ha-year, while precipitation gave 9.7 for a total of 183. The calcium loading due to land use varied from 19.8 Kg/ha-year for basin 103 to 261 for basin 109 and from 53 Kg/ha-year for pasture to 218 for corn to 971 for tobacco to 1330 for feed lots. Loading of magnesium due to land use practices averaged 19.5 Kg/ha-year and from precipitation was 3.3 for a total of 22.8. Loading of magnesium due to land use varied from 0.4 Kg/ha-year for basin 105 to 143 for basin 109 and from 6.7 Kg/ha-year for residential plus roads to 38.8 for hayfields to 87.6 for corn to 356 for feed lots. Overall, the weight ratio of nitrogen to phosphorus inputs was 3.26. (See also W79-10084) (Sims-ISWS)
W79-10094

NUTRIENT DISCHARGE FROM WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
G. S. Henderson, A. Hunley, and W. Selvidge.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume 1, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 307-322, 1977. 3 fig, 4 tab, 12 ref.

Descriptors: *Nutrients, *Watersheds(Basins), *Discharge(Water), Forest watersheds, Drainage, Chemicals, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sodium, Sulfur, Precipitation(Atmospheric), Rainfall, Runoff, Storm runoff, Fallout, Pollutants, Path of pollutants, Water pollution, *Walker Branch Watershed(TN).

Streamflow discharge of nutrient elements (N, P, K, Ca, Mg, Na and S) has been studied on Walker Branch Watershed for up to six years. Annual discharges of N, P and S are less than atmospheric inputs, whereas Ca, Mg, K and Na discharges exceed these inputs. Seasonal nutrient discharges are dependent on water yield. Concentration behavior of nutrients during storms has been used to identify processes within the watershed influencing nutrient release from the catchment. During storms, three patterns of concentration behavior were observed: dilution of concentration during stormflow (Ca and Mg); concentration increases during storms (N and S); and little change in concentration (dissolved K, P, Na) except for some concentration increase during autumn storms. These different patterns are caused by processes such as bedrock weathering, canopy and litter leaching, and expansion into variable source areas. Stormflow discharge is especially important in the transport of nitrogen and other elements primarily incorporated in organic matter. (See also W79-10084) (Sims-ISWS)
W79-10100

NUTRIENT EXPORT FROM THREE NORTH FLORIDA WATERSHEDS IN CONTRASTING LAND USE,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. M. Burton, R. R. Turner, and R. C. Harriss.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 323-342, 1977. 2 fig, 10 tab, 29 ref.

Descriptors: *Nutrients, *Watersheds(Basins), *Land use, *Florida, Rainfall, Runoff, Fallout, Urban runoff, Storm runoff, Forest watersheds, Chemicals, Chlorides, Silicon, Nitrogen, Phosphorus, Urbanization, Temporal distribution, Hydrographs, Water pollution, Pollutants, Path of pollutants.

Exports of nutrients from a forested-agricultural, a suburban, and an urban watershed in north Florida were measured from 1973 to 1975. The most significant impact of urbanization was the change in temporal distribution and quantity of total and dissolved P exports. The urban watershed exported 16 times more total ,P than does the forested-agricultural watershed with the suburban watershed intermediate. Further, 98% of this total P was exported in quickflow (stormflow) on the urban watershed, while only 53% was exported in quickflow on the forested-agricultural watershed. Dissolved P exports were relatively low from all 3 watersheds with the primary effect of urbanization being the temporal changes in export, with 77% of the urban exports being in quickflow compared to 35% for the forested-agricultural watershed. Exports of inorganic N were highest from the suburban watershed, probably as a consequence of septic tank drainage; exports of NO3-N were 6 times higher for the suburban and 3 times higher for the urban, sewered watershed compared to the forested-agricultural watershed. Si and Cl were also monitored. Mechanisms controlling export of P, N, Cl, and Si were emphasized. (See also W79-10084) (Sims-ISWS)
W79-10101

NUTRIENT YIELD ASSESSMENT BY DIFFERENT SAMPLING STRATEGIES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
M. R. Overcash, L. Bliven, F. Koehler, J. W. Gilliam, and F. J. Humenik.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 365-383, 1977. 4 fig, 8 tab, 1 ref. EPA R803328.

Descriptors: *Nutrients, *Sampling, *Watersheds(Basins), *Land use, Runoff, Streamflow, Chemicals, Water chemistry, Chemical oxygen demand, Oxygen, Phosphorus, Phosphates, Nitrogen, Nitrogen compounds, Pollutants, Path of pollutants, Water pollution, *Chowan River Basin(NC-VA).

A land use classification of 15 Chowan River subbasins representing 4 major soil-topographic regions was presented. A chemical concentration summary based on grab sample data was presented for the 4 regions. Regional as well as in-stream variations of the mean chemical concentrations were explored. The grab sample data were employed to demonstrate the differences in time average and volume average concentrations of total nitrogen and total phosphate for the 15 subbasins. Results of linear regressions between both total nitrogen and total phosphate yields and the dominant land use in the 15 subbasins were presented. (See also W79-10084) (Sims-ISWS)
W79-10102

SOIL WATER AND CHEMICAL MOVEMENT IN A SLOPING FRAGIPAN SYSTEM,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2G.
W79-10103

THE MAHANTANGO CREEK WATERSHED--SOURCE AND REACTION OF PHOSPHATE DURING STORM HYDROGRAPHS,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
W. R. Heald, and W. J. Gburek.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 401-411, 1977. 4 fig, 1 tab, 11 ref.

Descriptors: *Phosphates, *Path of pollutants, *Watersheds(Basins), *Hydrographs, Streamflow, Water pollution, Water pollution sources, Phosphorus, Phosphorus compounds, Nutrients, Runoff, Storm runoff, Sediments, Adsorption, Waste dilution, Mixing, Farm wastes, On-site investigations, Sampling, Hydrology, *Mahantango Creek Watershed(PA).

Measured spatial and temporal variations of phosphate concentrations during storm hydrographs were presented. The variations observed support the concept that the hydrologic and chemical contributing areas are similar and indicate the important phosphate reactions during storm flows. This investigation was conducted on the 420-sq-km Mahantango Watershed. Specific watershed characteristics relevant to this study are: soils are slightly acid; conservation practices recommended by the Soil Conservation Service are generally followed, resulting in little erosion from the fields; and most stream banks have a sod-forest plant cover. Data were collected only during the summer months because the low-flow conditions existing then make the storm hydrographs more distinct and shorter than the flow conditions during winter. The net effect of the 2 processes is as follows: During the initial rise of the storm hydrograph, there is a corresponding rise in (PO4-P). However, as the hydrograph moves downstream, (PO4-P) is continuously reduced by dilution and adsorption, even with continuous P inputs all along the stream. As precipitation diminishes, direct runoff decreases, thereby decreasing the dilution effect. However, phosphate input also decreases and the adsorption reaction continues to reduce soluble phosphate levels towards the equilibrium level that the sediment can support. (See also W79-10084) (Sims-ISWS)
W79-10104

NUTRIENT DISCHARGE FROM RHODE RIVER WATERSHEDS AND THEIR RELATIONSHIP TO LAND USE PATTERNS,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
D. L. Correll, T-L. Wu, E. S. Friebele, and J. Miklas.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume I, February 28-March 3, 1977. Report No. NSF/RA-770254. Smithsonian Institution, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 413-437, 1977. 3 fig, 7 tab, 14 ref. EPA R804536-01.

Descriptors: *Nutrients, *Runoff, *Watersheds(Basins), *Land use, Sampling, Water chemistry, Chemicals, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Streamflow, Base flow, Agriculture, Water pollution, Water pollution sources, Path of pollutants, Storms, Storm runoff, *Rhode River Watershed(MD).

Of the 983 ha of Rhode River watershed studied in 1975-76, 38% was used for row crops and pastureland. Annual nutrient area yield as runoff varied by about a factor of 3 between basins for most of these elements, and variation was much greater for seasonal area yields. Nutrient discharges varied about as much between years for a given basin as between basins for a given year. The storm behavior of basin 101 was much different from that of a nearby basin of similar size. This basin (103) normally only discharges half as much phosphorus per hectare-year as basin 101, and in this storm discharged 60 g P/ha in storm flow, which was only 23% of the total phosphorus discharged for the 6 month period. The only major characteristic which seemed different in these two basins was land use. Basin 101 (high storm discharge) had 9.6% cultivated land, 27.2% pasture plus hayfield, and 6% residential plus roads. Basin 103 had only 2.0% cultivated, 16.5% pasture, and 4.6% residential plus roads. Using 1975 runoff yields from 7 basins, average area yield loading factors for each nutrient were calculated with a statistical model for 3 land use classes: cultivated, pasture, and forest. These were highest for pasture for all elements but potassium, second highest for cultivated land, and very low for forest. (Area yields from pasture and cultivated lands were nearly equal for potassium). (See also W79-10084) (Sims-ISWS)
W79-10105

PATTERNS OF ORGANIC MATTER TRANSPORT ON WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10106

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME II, FEBRUARY 28-MARCH 3, 1977.
For primary bibliographic entry see Field 2A.
W79-10107

LARGE PARTICULATE ORGANIC MATTER PROCESSING IN STREAM ECOSYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 2A.
W79-10109

BASELINE LEVELS AND SEASONAL VARIATIONS OF ENTERIC BACTERIA IN OLIGOTROPHIC STREAMS,
Georgia Univ., Athens. Inst. of Ecology.
M. R. McSwain.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 555-574, 1977. 9 fig, 3 tab, 12 ref. NSF DEB-77-5324.

Descriptors: *Oligotrophy, *Forest watersheds, *North Carolina, *Enteric bacteria, Streams, Mountains, Coliforms, Bacteria, Water sampling, On-site investigations, Streptococcus, Small watersheds, Demonstration watersheds, Water quality, Seasonal, Water temperature, On-site data collections.

In mountain streams at the Coweeta Hydrologic Laboratory, Franklin, North Carolina, naturally

occurring populations of enteric bacteria fluctuated seasonally and diurnally. Measurements of enteric bacteria were correlated with stream turbidities and stream temperatures. Data suggested that seasonal cycles were caused by multiplication of enteric bacteria in bottom sediments and that multiplication was regulated by stream temperatures. However, fecal streptococci were less responsive to changes in turbidity than were coliforms. Elevated levels of total and fecal coliforms during storms appeared more related to bottom sediment disturbances than to streambank flushing. In contrast, increases in fecal streptococcus counts during storms appeared more related to the washing of overhanging stream vegetation and streambank flushing. Diurnal cycling of enteric bacteria during baseflow periods was inversely related to diurnal cycles of streamflow. The results from this study in western North Carolina suggested that the response of enteric bacteria to selected physical parameters is somewhat site-specific because of differences in soil type, degree of stream channel cover, and climatic factors. (See also W79-10107) (Humphreys-ISWS)
W79-10111

THE ROLE OF NITRIFICATION IN NUTRIENT CYCLING OF FORESTED ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Agronomy.
N. A. Phillips, R. Rower, and R. L. Todd.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 579-590, 1977. 4 tab, 12 ref.

Descriptors: *Forest watersheds, *Cycling nutrients, *Reviews, *Ecosystems, Nutrients, Nitrification, Nitrogen, Water quality, Forest management.

In this review, nitrate-nitrogen levels in streamflow were compared for a number of manipulated forested watersheds. The microbial mediated conversion of ammonium-nitrogen to nitrate-nitrogen (nitrification) was discussed as it relates to nitrate-nitrogen content in runoff water. Hypotheses for system control of the nitrification process were reviewed. Studies of nutrient cycling in forested watersheds indicate that nitrate-nitrogen losses in stream flow is an indicator of system perturbation. This elevated level of nitrate-nitrogen was proposed to result from the action of terrestrial nitrifying bacterial activity. Climax forest ecosystems were proposed to have evolved means to control nitrification thereby preventing nitrate-nitrogen losses. As the need for forestry management increases, consideration must be given to be a better understanding of the nitrification process. (See also W79-10107) (Humphreys-ISWS)
W79-10112

ALGAL DIVERSITY AND TRANSPORT IN SMALL STREAMS,
North Carolina State Univ. at Raleigh. Inst. of Statistics.
D. W. Hayne, A. M. Witherspoon, and T. R. Fisher.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 593-607, 1977. 3 fig, 5 tab, 19 ref. EPA R803328.

Descriptors: *Algae, *Streams, *North Carolina, *Virginia, Biomass, Coastal plains, Water quality, On-site investigations, Water sampling, Analytical techniques, Analysis, Data collections, *Chowan River(NC), Algal diversity, Algal transport.

The Chowan River basin lies on the border of Virginia and North Carolina and drains east into Albemarle Sound. Data were presented from a one-year study of algal numbers, biomass, and diversity in two sub-basins of the Chowan, one a more rapidly flowing piedmont stream originating from well-drained soils, and the other a more sluggish coastal plain stream originating from poorly drained soils and swamps. The objective of the study was to explore the usefulness of algal abundance and diversity in the study of water quality and characterization of streams. (See also W79-10107) (Humphreys-ISWS)
W79-10113

BASIN SIZE, WATER FLOW AND LAND-USE EFFECTS ON FECAL COLIFORM POLLUTION FROM A RURAL WATERSHED,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
M. A. Faust, and N. M. Goff.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 611-632, 1977. 5 tab, 19 ref

Descriptors: *Agricultural watersheds, *Water pollution sources, *Runoff, *Maryland, Land use, Water pollution, Analysis, Regression analysis, Bacteria, Water sampling, Watersheds(Basins), Coliforms, Discharge(Water), On-site investigations, Water quality, Forests, Pastures, Freshwater marshes, Crops, Cultivation, Agricultural runoff, Data collections, Livestock, *Rhode River(MD), Coliform discharge.

A comprehensive study was undertaken on the effects of a series of environmental variables on fecal coliform (FC) discharge from 983 ha of Rhode River (Maryland) watershed. Seven subwatershed basins, ranging in size from 28 to 254 ha, were instrumented to monitor water discharge rates. Of the monitored watershed area, 61% was forest and old field, 16% was cultivated cropland, 18% was pasture, while the remaining 5% was residential and freshwater wet areas. The average human and livestock densities of these basins are 0.31 person/ha and 0.53 livestock/ha. Water discharge estimated by weekly spot sampling of water flow was significantly correlated with weekly automated flow measurements (R sq = 0.992). Therefore, weekly spot sampling data were used to establish FC discharge from the basins. Water runoff was positively correlated with basin size (R sq = 0.973) and stream length (R sq = 0.922). Fecal coliform discharge was also positively correlated with water flow at all weirs at all seasons, with stream length (R sq = 0.799) and with basin size (R sq = 0.900). Fecal coliform discharge from three land uses was also estimated. From pasture the discharge was 89 x 10 to the 9th power FC ha/yr, from forest 22.4 x 10 to the 9th power FC ha/yr, and from cultivated land 19.8 x 10 to the 9th power FC ha/yr. From the entire study area, 68% of FC was discharged from pasture, 17% from forest, and 15% from cultivated land. (See also W79-10107) (Humphreys-ISWS)
W79-10114

SELECTED PATHOGENIC MICROORGANISMS CONTRIBUTED FROM URBAN WATERSHEDS,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
V. P. Olivieri, C. W. Kruse, K. Kawata, and J. E. Smith.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 635-659, 1977. 6 fig, 7 tab, 29 ref.

Descriptors: *Water pollution sources, *Urban drainage, *Microorganisms, *Maryland, Storm runoff, Pathogenic bacteria, On-site investigations, Coliforms, Viruses, Water sampling, Storm water, Reservoirs, Water quality, Water pollution, Data collections, Streams, Urban watersheds.

Grab samples were collected from 3 urban streams, 6 storm drains, raw sewage, and an upland reservoir during a 13-month period in Baltimore City, Maryland. Each sample was assayed for levels of Salmonella sp., enteric viruses, Pseudomonas aeruginosa, Staphylococcus aureus and indicator bacteria (total coliform, fecal coliform, and fecal streptococci. Pathogenic microorganisms were consistently isolated from urban streams and storm runoff. The most numerous pathogens were P. aeruginosa and Staph. aureus at geometric mean densities of 290 to 6600/100 ml and 3 to 120/100 ml, respectively. Salmonella sp. and enteric viruses, though recovered at high frequencies, required concentration and were found at geometric mean densities of 5 to 140/101 and 7 to 280/101, respectively. Levels of indicator and pathogenic microorganisms were approximately 10-fold higher in the stormwater samples. Except for a slight elevation in the levels of P. aeruginosa in the fall, there appeared to be no marked seasonal variation in the levels of microorganisms. The density of fecal coliform appeared to be independent of instantaneous flow and the number of days since the last rainfall for both the urban stream and storm samples. The microbial quality of the urban streams and storm runoff was uniformly poor. Only 3 of 92 stream samples and 1 of 136 stormwater samples met the recommended 200 fecal coliform/100 ml standard. (See also W79-10107) (Humphreys-ISWS)
W79-10115

DYNAMICS OF TRACE ELEMENT EXPORT FROM A DECIDUOUS WATERSHED, WALKER BRANCH, TENNESSEE,
Oak Ridge National Lab., TN.
R. R. Turner, S. E. Lindberg, and K. Talbot.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 661-681, 1977. 3 fig, 6 tab, 29 ref.

Descriptors: *Trace elements, *Tennessee, *Metals, *Streamflow, *Watersheds(Basins), Sampling, Chemicals, Chemical analysis, Dissolved solids, Suspended solids, Carbon, Heavy metals, Cadmium, Copper, Chromium, Manganese, Lead, Zinc, Iron, Data processing, Correlation analysis, Pollutants, Path of pollutants, Water pollution, *Walker Branch Watershed(TN).

As part of an integrated study of trace contaminant behavior on a landscape scale, concentrations of several trace elements in both dissolved and particulate form were measured regularly in streamflow from Walker Branch Watershed during the period September 1975 to August 1976. In general, Cd, Cu, and Cr were transported primarily in dissolved form, with the relative fraction in particulate form increasing during storms. Iron and Mn, responding to the high pH (approximately 8.0) and oxygenated conditions of the stream, were transported primarily in particulate form. Dissolved Mn, and to a lesser extent dissolved Zn, generally increased in concentration as streamflow increased during storms, while dissolved Cr and dissolved Pb generally decreased. Dissolved levels of Cu, Mn, Zn, and Fe were correlated positively with dissolved organic carbon concentration, which frequently increased rapidly during early stormflow (i.e., indicating a flushing effect). Analysis of elements associated with stream particulate matter showed positive correlation between concentrations of several trace elements and Fe and Mn. The 12-month streamflow exports of Cd, Cr, Cu, Pb, Zn, Mn, and Fe were respectively 0.15, 0.49, 0.69, 2.22, 12.4, 193, and 316 grams/hectare. (See also W79-10107) (Sims-ISWS)
W79-10116

LAND UTILIZATION AND METALS DISCHARGE FROM THE RHODE RIVER WATERSHED,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
T. L. Wu, and M. T. Hoopes.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 683-706, 1977. 2 fig, 7 tab, 16 ref, 1 append.

Descriptors: *Metals, *Maryland, *Heavy metals, *Land use, *Streamflow, Watersheds(Basins), Sampling, Chemicals, Seasonal, Iron, Manganese,

Zinc, Chromium, Lead, Copper, Cadmium, Pollutants, Path of pollutants, Water pollution, Data processing, *Rhode River Watershed(MD).

Volume-integrated samples from 7 subwatershed basins of the Rhode River during 1975 were analyzed weekly for their heavy metals content. The yearly metals discharge per hectare for iron, manganese, zinc, chromium, cadmium, copper, and lead were calculated, and were found to vary for each basin and each metal. Generally, metals discharge decreases in the order of Fe, Mn, Zn, Cr, Pb, Cu, and Cd. A statistical model was employed to calculate the area yield loading rates of these heavy metals for the 3 different categories of land utilization in the Rhode River watershed, pasture, forest, and cultivated fields, on a seasonal basis. During the summer of 1975, pasture has the highest loading rate for most metals, while cultivated land showed the highest loading rate during the fall season of 1975 for Fe, Mn, and Zn. The discharge of Cr, Fe, Zn, and Pb was found to increase on a seasonal basis from winter through summer and then to decrease in the fall, while the Mn and Cu discharge matched the water discharge, and Cd was found to have a reverse relationship to water discharge. In addition, analysis of suspended particles versus the metals concentration indicated that only Fe is transported primarily in particulate form. (See also W79-10107) (Sims-ISWS)
W79-10117

RUNOFF STUDIES OF THE AGRICULTURAL HERBICIDES ALACHLOR AND ATRAZINE FROM THE RHODE RIVER WATERSHED DURING THE 1976 GROWING SEASON,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
T. L. Wu, N. J. Mick, and B. M. Fox.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 707-726, 1977. 7 fig, 7 tab, 7 ref. EPA R804536-01.

Descriptors: *Herbicides, *Maryland, *Runoff, *Agricultural chemicals, Soils, Rainfall, Soil moisture, Soil temperature, Agricultural runoff, Sampling, Chemicals, Crops, Corn(Field), Pollutants, Path of pollutants, Water pollution, Water pollution sources, Agriculture, *Rhode River Watershed(MD), Alachlor, Atrazine.

During the growing season of 1976, an intensive monitoring program of a small basin of the Rhode River watershed was carried out. A corn field of 16.4 hectares was treated with alachlor and atrazine. Concentrations of these herbicides in the soil profile and in runoff water from the corn field were determined. The runoff study was made possible by construction of two V-notched weir monitoring stations, one located immediately at the bottom of the drainage furrow of the corn field, the other one located down stream from this channel. Major concentrations of alachlor were found to remain on and above about 5 cm of soil profile. The residual alachlor was greatly reduced after 15 days of its application in the field. The residual atrazine showed a different pattern in its movement in soil. Detectable concentrations of atrazine were found in the deeper soil profile (24-30cm) 109 and 148 days after the atrazine application in the field. Atrazine and alachlor concentrations were determined in the runoff water during the 1976 growing season. Both particulate and dissolved phases were studied. Although enrichment of both atrazine and alachlor in the runoff particulates was detected, the transport of atrazine and alachlor in the dissolved phase of runoff water was often substantial. The detected runoff loss of atrazine for the corn field studied was calculated to be 1.2%; the runoff loss of alachlor was only 0.02%. (See also W79-10107) (Sims-ISWS)
W79-10118

SAMPLING METHODOLOGIES FOR ASSESSING RURAL RUNOFF,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W79-10121

A LINEAR APPROACH TO THE CALCULATION OF AREA YIELD COEFFICIENTS BASED ON LAND USE,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
G. R. Chirlin, and D. L. Correll.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 831-859, 1977. 2 fig, 3 tab, 9 ref, 1 append. EPA R804536-01.

Descriptors: *Water pollution sources, *Land use, *Model studies, Mathematical models, Equations, Runoff, Pollutants, Phoshorus, Chemicals, Rainfall, Precipitation(Atmospheric), Streams, Rivers, Watersheds(Basins), Water quality, *Rhode River Watershed(MD).

A model was presented which expresses waterborne mass flux out of a basin as a linear combination of the areas within the basin in each of several land use classes. The model structure may be formally derived from two distinct sets of assumptions, the less involved of which is simply a weighted least squares formulation. The weights were chosen equal to the inverse of estimated variances for the basin mass flux values. An example applied to total phosphorus export from 7 basins in 3 land uses in summer 1975 yielded the following loading coefficients: row crops export=522, pasture export=620, and forest export=106 g-P/ha/season. Sensitivity of this solution to the weighting scheme and the measured loadings was explored for 3 contrasting basins. General classes of behavior: 'underloading', 'overloading', and 'well-predicted loading' emerged during the analysis, suggesting directions of further inquiry in the analysis of the basin loading data. (See also W79-10107) (Sims-ISWS)
W79-10123

MODELING SEDIMENT TRANSPORT IN NATURAL CHANNELS,
Hydrocomp, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 2J.
W79-10124

APPLICATIONS OF A MARYLAND VERSION OF USDAHL-74 TO A WATERSHED IN PRINCE GEORGE'S COUNTY, MARYLAND,
Maryland Univ., College Park.
For primary bibliographic entry see Field 2A.
W79-10125

AGRICULTURALLY RELATED WATER QUALITY PROBLEMS IN RAPID CREEK,
South Dakota School of Mines and Technology, Rapid City.
L. L. Harms.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 819, Price codes: A04 in paper copy, A01 in microfiche. Completion Report prepared for the South Dakota Water Resources Research Institute, Brookings, June 1979. 55 p, 7 fig, 33 tab, 9 ref, 2 append. OWRT A-067-SDAK (1).

Descriptors: *South Dakota, *Waste water treatment, *Water pollution effects, Water analysis, Water sampling, Irrigation, Agriculture, Alfalfa, Stock water, Livestock, Conductivity, Water properties, Alkalinity, Degradation(Stream), Salts, Ammonia, Phosphorus.

Water samples from a portion of Rapid Creek downstream from the Rapid City, South Dakota, municipal waste-water treatment facility were collected and analyzed due to reported user problems. A subjective field survey of users below the treatment facility revealed that 69% thought that the water was unsuitable for livestock use and 25% felt that use of the water for irrigation caused abnormal retarded alfalfa growth. Grab samples were taken once or twice monthly in 1978 from February to May. From May to mid-September, the irrigation season, samples were taken weekly. During the sampling period precipitation and streamflow were near normal. Water quality data collected included pH, temperature, specific condition, chloride content, suspended solids, volatile suspended solids, total hardness, total residue, total phosphorus, sodium adsorption ratio, alkalinity, and various other mineral content levels. Results show that water quality does decrease as it progresses downstream and the wastewater treatment facility is responsible for some of the degradation. Major problem areas were specific conductance, total salts, chloride, ammonia, nitrates, sodium, and phosphorus. However, the levels involved in these problem areas were not significant enough to cause the reported livestock and irrigation problems. (Seigler-IPA)
W79-10158

METHODS OF ULTIMATE CARBONACEOUS BOD DETERMINATION,
Geological Survey, Doraville, GA. Water Resources Div.; and Geological Survey, Portland, OR. Water Resources Div.
J. K. Stamer, S. W. McKenzie, R. N. Cherry, C. T Scott, and S. L. Stamer.
Journal of the Water Pollution Control Federation, Vol. 51, No. 5, p 918-925, May 1979. 9 fig, 2 tab, 11 ref.

Descriptors: *Water quality, *Water pollution sources, *River basins, *Georgia, *Biochemical oxygen demand, Nitrification, Dissolved oxygen, Waste water(Pollution), Path of pollutants, Municipal wastes, Oxygen demand, *Upper Chattachoochee River basin, *Atlanta area(Ga), Chemical nitrifying inhibitors, Rates of carbonaceous oxygen.

The combined use of time-series biochemical oxygen demand analysis and Lee's graphical method provides a reliable technique for determining ultimate carbonaceous biochemical oxygen demand and the rate at which this demand is exerted. During the 5-to-7 day incubation period, measurements of dissolved-oxygen concentrations provide adequate definition of the amount and rate of carbonaceous biochemical oxygen demand. Comparable ultimate carbonaceous biochemical oxygen demand concentration and carbonaceous reaction rate can be determined from nonnitrified samples using no chemical nitrifying inhibitor and from partially nitrified samples using the chemical inhibitors, 1-allyl-2 thiourea or nitrapyrin. (Woodard-USGS)
W79-10180

GROUND WATER QUALITY DATA FROM A SLUDGE DISPOSAL TEST SITE, ST. PETERSBURG, FLORIDA, NOVEMBER 1973-JULY 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Fernandez, Jr.
Geological Survey open-file report 78-821, 1979. 101 p, 2 fig, 6 tab.

Descriptors: *Water quality, *Water analysis, *Groundwater, *Sludge disposal, *Observation wells, Well data, Path of pollutants, Anaerobic digestion, Chemical analysis, Metals, Trace elements, Nitrogen, Phosphorus, Coliforms, Biochemical oxygen demand, Chemical oxygen demand, Soil management, *St Petersburg(FL), Sod farm.

From November 1973 to July 1977, water samples were collected from wells to identify background water-quality conditions and to determine the effects on ground-water quality by St. Petersburg's sludge-disposal operation (sod farm). Specific conductance and pH were determined in the field. Samples were collected for laboratory determination of selected nitrogen and phosphorus species, sodium, potassium, calcium, magnesium, chloride, trace metals, chemical and biochemical oxygen demand, and coliforms. (Woodard-USGS)
W79-10182

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WATER-QUALITY DATA FROM A LANDFILL, PINELLAS COUNTY, FLORIDA, MAY 1975-OCTOBER 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Fernandez, Jr.
Geological Survey open-file report 78-822, 1979. 97 p, 2 fig, 8 tab.

Descriptors: *Baseline studies, *Landfills, *Waste disposal, *Water quality, *Groundwater, Path of pollutants, Observation wells, Well data, Data collections, Water analysis, Metals, Trace elements, Nitrogen, Coliforms, Herbicides, Pesticides, *Pinellas County(FL).

Beginning in May 1975, surface- and ground-water samples were collected periodically to obtain certain background water-quality conditions at a landfill site in Pinellas County, Florida. Landfill operation began in November 1975, and water analysis continued to October 1977. Specific conductance and pH were determined in the field. Samples were collected for laboratory determination of selected nitrogen and phosphorus species, sodium, potassium, calcium, magnesium, trace metals, chloride, pH, specific conductance, chemical and biochemical oxygen demands, specific pesticides, and herbicides and coliforms. The collected data are presented. (Woodard-USGS)
W79-10183

EFFECTS OF ORGANIC WASTE ON PRIMARY AND SECONDARY PRODUCTION IN THE EMS-DOLLARD ESTUARY,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5A.
W79-10192

MERCURY IN THE AQUATIC ECOSYSTEMS OF THE PROVINCE OF QUEBEC, CANADA (IN FRENCH),
Environmental Protection Service, Montreal (Quebec).
For primary bibliographic entry see Field 5A.
W79-10194

MERCURY AND SELENIUM CONTENT OF ODONTOCETI, (IN JAPANESE)
Tokai Regional Fisheries Research Lab., Tokyo (Japan).
S. Arima, and K. Nagakura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 5, p 623-626, 1979. 3 fig, 3 tab, 15 ref

Descriptors: *Mercury, *Path of pollutants, Chemical analysis, Fish physiology, Animal metabolism, Growth stages, Mammals, Aquatic animals, Heavy metals, Size, *Selenium, *Tissue analysis, *Bioaccumulation, *Porpoise, *Dolphin, *Whale, *Seal.

Several species of Odontoceti from the coastal waters of Japan were analysed for total mercury and selenium content in the muscle. The highest mercury content, 51.8 ppm, was found in Gill's Bottle-nosed Dolphin (Tursops gilli). The lowest value, 0.16 ppm, was obtained in the foetus of Finless Black Porpoise (Neophocaena phocaenoides). The mean mercury contents were 4.63 ppm (0.95-9.43) in Blue White Dolphin (Stenella caeruleo-alba) and 4.16 ppm (3.01-5.18) in Pilot Whale (Globicephala melaena). These values are rather high compared with those of marine mammals such as seals and whales. The mercury content in muscle increases linearly along with the age of animals. A high correlation was obtained between mercury and selenium content in the muscles of all species investigated. The molar ratio of mercury to selenium was about 1:1, indicating an excess of mercury in muscles. (Deal-EIS)
W79-10196

HEAVY METAL CONCENTRATIONS AND PHYTOPLANKTON PRODUCTION, BIOMASS AND STRUCTURE IN A NORTHERN ESTUARINE AREA OF THE BALTIC SEA,
Salt and Water Ltd., Helsinki (Finland).
For primary bibliographic entry see Field 5A.
W79-10197

RATIO ATP/CHLOROPHYLL AS AN INDEX OF RIVERS' WATER QUALITY,
Istituto di Ricerca Sulle Acque, Rome (Italy).
For primary bibliographic entry see Field 5A.
W79-10198

MUDDY OFF-FLAVOUR IN BREAM (ABRAMIS BRAMA L.) FROM THE PORVOO AREA, GULF OF FINLAND,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W79-10203

AMMONIFICATION PROCESSES IN FERTILIZED LAKES,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
For primary bibliographic entry see Field 5A.
W79-10210

MERCURY CIRCULATION IN AQUATIC BIOCONESES, PART 1: MERCURY (II)-METABOLISM IN PHYTOPLANKTON,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia).
For primary bibliographic entry see Field 5A.
W79-10213

DETERMINATION OF TOTAL AMMONIA NITROGEN AND CHEMICAL OXYGEN DEMAND IN FISH CULTURE SYSTEMS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquaculture.
For primary bibliographic entry see Field 5A.
W79-10215

HEMATOLOGY AS INDEX OF SUBLETHAL TOXICITY OF ZINC IN A FRESHWATER TELEOST,
Gorakhpur Univ. (India). Dept. of Zoology.
S. Mishra, and A. K. Srivastava.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 695-698, 1979. 1 tab, 15 ref.

Descriptors: *Fish physiology, *Zinc, *Toxicity, Hematology, Sublethal toxicity, Metals, Teleost, Animal metabolism, Bioassay, Lethal limit, Chemical analysis, Biochemistry, Path of pollutants, Water chemistry, *Colisa.

Colisa fasciatus were exposed under laboratory conditions to zinc sulphate at sublethal concentrations (100 ppm) for 90 h. Each fish was then anesthetized and blood samples taken for analysis. Total red cell counts, hematocrits, total white cell counts, and the number of small lymphocytes/1000 cells decreased significantly, while erythrocyte sedimentation rate increased markedly from corresponding control values. The hemoglobin content, clotting time, and total and differential thrombocyte counts remained well within limits observed in controls. Significantly higher hepatosomatic index was recorded for zinc-treated fish as compared with unexposed animals. (Deal-EIS)
W79-10218

ORGANOCHLORINE RESIDUES IN RAPTOR EGGS IN THE CAYUGA LAKE BASIN,
National Wildlife Federation, Washington, DC.
J. L. Lincer, and R. J. Clark.
New York Fish and Game Journal, Vol. 25, No. 2, p 121-128, 1978. 2 tab, 33 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Bird eggs, *Pesticide toxicity, *Pesticide residues, DDE, Dieldrin, Polychlorinated biphenyls, New York, Heptachlor, Chemical analysis, Chromatography, Marsh birds, *Raptors, *Hawks, *Buteos, *Owls, *Kestrels, *Bioaccumulation, *Tissue analysis.

Organochlorine residue burdens and eggshell thinning in the eggs of hawks and owls nesting in the Canyon Lake Basin in central New York were compared. Except for those of the buteos (red-tailed hawk, red-shouldered hawk and broad-winged hawk), all the eggs examined contained high, but variable, DDE levels. Values in eggs of the red-tailed hawk ranged from approximately 2 to 14 ppm, and those for other buteos fell within this span. Eggs of the screech owl, American kestrel and Cooper's hawk contained intermediate mean residue levels (12 to 67 ppm). The highest mean DDE level and the highest DDE level in an individual egg were exhibited by the great horned owl (102 and 248, respectively). Limited data on residues are also presented for dieldrin, heptachlor epoxide and PCB's. Data on eggshell thinning indicated that there had been little decrease in shell thickness for eggs of the buteos, while for eggs of the great horned owl and American kestrel shell thickness had decreased about 10 per cent. The Cooper's hawk exhibited the greatest increase in the degree of eggshell thinning (10 per cent), and its situation may be critical. The ecological factors responsible for residue differences between hawk-owl counterparts, as well as needed research, are discussed. (Deal-EIS)
W79-10220

BIOASSAY OF BALTIMORE HARBOR SEDIMENTS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 5A.
W79-10227

THE DETECTION OF MUTAGENIC CHEMICALS IN THE TISSUE OF THE MUSSEL MYTILUS EDULIS,
University Coll. of Swansea (Wales). Dept. of Genetics.
For primary bibliographic entry see Field 5A.
W79-10228

TILE FLOW RESPONSE IN A LAYERED SOIL,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W79-10248

PREDICTION OF POLLUTANT RELEASE RESULTING FROM DREDGING,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 5A.
W79-10256

CARBON ISOTOPE RATIOS OF PARTICULATE ORGANIC MATTER IN THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 2L.
W79-10258

CHANGES IN THE AMOUNT OF ORGANOCHLORINE PESTICIDES IN MACROINVERTEBRATE COMMUNITIES OF THE VAL PARMA RUNNING WATERS (ITALY),
Parma Univ. (Italy). Lab. di Ecologia.
For primary bibliographic entry see Field 5A.
W79-10270

EFFECTS OF EFFLUENTS FROM A VARIETY OF SEWAGE TREATMENT METHODS ON PRIMARY PRODUCTIVITY, RESPIRATION AND ALGAL COMMUNITIES IN ARTIFICIAL STREAM CHANNELS,
Norsk Inst. for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A.
W79-10271

SUCCESSION OF PHYTO- AND ZOOPLANKTON IN A WASTEWATER STORAGE RESERVOIR,
Mekorot Water Co., Tel Aviv (Israel).
For primary bibliographic entry see Field 5A.
W79-10272

PONTOPOREIA DISTRIBUTION ALONG THE KEWEENAW SHORE OF LAKE SUPERIOR AFFECTED BY COPPER TAILINGS),
Michigan Technological Univ., Houghton, MI. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-10274

PHYTOPLANKTON POPULATION DYNAMICS AND PRODUCTIVITY IN A SEWAGE-ENRICHED TIDAL CREEK IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W79-10275

SEXUAL MATURATION AS A SOURCE OF VARIATION IN THE RELATIONSHIP BETWEEN CADMIUM CONCENTRATION AND BODY WEIGHT OF MYTILUS EDULIS L.,
Institut National de la Recherche Scientifique, Rimouski (Quebec). Lab. Oceanographique.
For primary bibliographic entry see Field 5A.
W79-10278

HYDROBIOLOGICAL AND CHEMICAL RESPONSE TO THE ADDITION OF IRON AND ALUMINUM SALTS, STUDIED IN THREE LUND-TYPE BUTYLRUBBER RESERVOIRS,
Koudekerk a/d Rijn (The Netherlands).
For primary bibliographic entry see Field 5A.
W79-10280

DEVELOPMENT OF PLANKTONIC ALGAE IN THE RUHR RIVER DEPENDENT ON NUTRIENT SUPPLY, WATERFLOW, IRRADIANCE AND TEMPERATURE,
Ruhr River Association, Essen (Germany, F.R.). Chemical and Biological Lab.
For primary bibliographic entry see Field 5A.
W79-10284

AN ATTEMPTED POLLUTION ABATEMENT IN THE GULF OF LA NAPOULE (CANNES, FRANCE),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
G. L. Bellan.
Marine Pollution Bulletin, Vol. 10, p 166-169, 1979. 2 fig, 1 tab, 9 ref.

Descriptors: Water pollution effects, *Domestic wastes, *Benthos, Waste disposal, Effluents, *Effluent pipeline, Mediterranean, Gulf of La Napoule, *Animal groupings, Path of pollutants, Water pollution sources, Indicator organisms, Waste water disposal, Scolelepis, Capitella.

A benthic survey was carried out in 1973 at the servicing of a 1285 m long submarine pipe designed to achieve pollution abatement in the Gulf of La Napoule (Cannes, French Mediterranean coast) and repeated 4 years later (1977). This last survey points to a good recovery of benthic communities in the eastern part of the Gulf (off Cannes) but a severe change in the western part of the Gulf with the appearance, in a deposition area, of the species Scolelepis fuliginosa and Capitella capitata which are highly characteristic of polluted areas and which had not been sampled during the first survey. The biological survey indicated that the disposal line did not work as anticipated. It was obvious that the hydrodynamic studies were inadequate and the submarine pipe was too short. (Katz-EIS)
W79-10288

EFFECTS OF SELFPURIFICATION AND THE BENTHIC ORGANIC LOAD ALONG A STREAM POLLUTED BY A PIGGERY, (IN FRENCH),
Centre Universitaire de Chambery (France).
For primary bibliographic entry see Field 5A.
W79-10290

MINERAL AND PURINIC BIOACCUMULATION IN AQUATIC INSECTS,
Laboratoire d'Histophysiologie des Insetes Paris (France).
For primary bibliographic entry see Field 5A.
W79-10292

EFFECTS OF THERMAL DISCHARGE ON LEAF DECOMPOSITION IN A RIVER ECOSYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
R. W. Paul, Jr., E. F. Benfield, and J. Cairns, Jr.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1759-1766, 1978. 3 fig, 1 tab, 20 ref.

Descriptors: *Food chain, *Degradation(Decomposition), Environmental effects, *Thermal power plant, Water pollution effects, Water temperature, Organic matter, *Leaf decomposition, New River, Glen Lyn, Virginia, On-site-investigation, Leaf decay, Lignin, Cellulose, Hemicellulose.

The degradation of leaf material in the New River in the vicinity of a fossil fuel electric generating plant at Glen Lyn, Virginia was studied. The effects of the heated discharge on leaf pack degradation appeared to be stimulating resulting in degradation rates that were significantly higher in the heated portion of the stream. Authors postulate a profound effect on the detrital food web in the heated areas of the stream. The impact of this on the total system was not determined. (Katz-EIS)
W79-10295

EFFECT OF AGE, WEIGHT, AND SEX ON THE MERCURY CONTENT IN THE MUSCLES AND SELECTED ORGANS OF NORTHERN PIKE (ESOX LUCIUS L.), (IN POLISH),
Instytut Technologii zym Zywnosci Pochodzenia Morskiego, Szczecin (Poland).
For primary bibliographic entry see Field 5A.
W79-10299

CONCENTRATIONS OF PCBS, BHCS AND DDTS RESIDUES IN SEAWEEDS OF THE EAST COAST OF SICILY,
Catania Univ. (Italy). Inst. di Chimica e Chimica Industriale.
For primary bibliographic entry see Field 5A.
W79-10301

SOME PRELIMINARY DATA ON NUTRIENTS AND CHLOROPHYLL IN ORGANICALLY POLLUTED RIVERS (GRANADA/SOUTH SPAIN),
Granada Univ. (Spain). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10303

INFLUENCE OF THE FISHSTOCK ON THE PHOSPHORUS-CHLOROPHYLL RATIO,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
For primary bibliographic entry see Field 5A.
W79-10305

CHANGES OF PHYTOPLANKTON COMPOSITION AND ITS CHARACTERISTICS DURING RED TIDE SEASON, (IN JAPANESE),
Tokai Regional Fisheries Research Lab., Tokyo (Japan). Water Quality Div.
For primary bibliographic entry see Field 5A.
W79-10306

CHANGES IN DDT, DDE AND DDD CONTENTS DURING PRODUCTION OF CANNED HERRING (THE 'GDANSK HERRING'), (IN POLISH),
Instytut Technologii zym Zyrnosci Pochodzenia Morskiego. Szczecin (Poland). Zaklad Higieny Przemyslu Rybengo.
For primary bibliographic entry see Field 5A.
W79-10308

EXPERIMENTAL REARING OF RAINBOW TROUT (SALMO GAIRDNERI RICH.) IN COOLING WATERS OF 'DOLNA ODRA' POWER STATION),
Institute of Marine Biological Resources Exploitation and Protection, Szcecin (Poland).
For primary bibliographic entry see Field 5A.
W79-10310

CONCENTRATION FACTORS OF THE ELEMENTS COBALT, MANGANESE, IRON, ZINC AND SILVER FOR FISH,
Bundesforschunganstalt fuer Fisherei, Hamburg (Germany, F.R.). Istopenlaboratorium.
For primary bibliographic entry see Field 5A.
W79-10311

PHYSICAL AND CHEMICAL FACTORS AFFECTING FISH DISTRIBUTION IN LAKE MANZALAH-EGYPT,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
For primary bibliographic entry see Field 5A.
W79-10316

A RED TIDE OCCURRED AT THE HAKOZAKI FISHING PORT, HAKATA BAY, IN 1973. THE GROWTH PROCESS AND THE CHLOROPHYLL CONTENT,
Tokai Regional Fisheries Research Lab., Tokyo (Japan). Water Quality Div.
For primary bibliographic entry see Field 5A.
W79-10317

STREPTOMYCES SP: A SOURCE OF ODOROUS SUBSTANCES IN POTABLE WATER,
Auburn Univ., AL. Dept. of Botany and Microbiology.
J. D. Weete, W. Y. Huang, and J. L. Laseter.
Water, Air and Soil Pollution, Vol. 11, p 217-223, 1979. 1 fig, 1 tab, 39 ref. OWRT A-057-ALA(1), 14-34-0001-7001.

Descriptors: *Chromatography, *Mass spectrometry, Contaminants, *Steptomyces, Butyric acid.

Growth medium containing an aquatic actinomycete Steptomyces sp. was analyzed by gas-liquid chromatography and mass spectrometry for the purpose of identifying substances that may represent potential odorous contaminants of water. Twenty-one odorous and nonodorous compounds were identified. Phenyl, C2 and C4 structures were predominant. Free fatty acids from C13 to C16 were detected and in some cases accompanied by their ethyl (C16) and butyl (C15 and C16) esters. The long-chain acids and esters had no detectable odor. Although geosmin, an earthy smelling substance with a low odor threshold, was detected, butyric acid was the principal metabolite under the growth condition employed and represented the greatest potential as an odorous water pollutant under natural conditions.
W79-10321

5C. Effects Of Pollution

THE ROLE OF NITRIFICATION IN NUTRIENT CYCLING OF FORESTED ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W79-10112

THE EVOLUTION OF WATER QUALITY MANAGEMENT, PART I,
R. D. Henningan.
Clearwaters, New York Water Pollution Control Association, Inc., Vol. 9, No. 2, p 12-14, June 1979. 1 tab, 1 ref.

Descriptors: *New York, *Water quality control, *Water management(Applied), Water pollution control, Diseases, Environmental sanitation, Sewage disposal, Public health, Epidemics, Human diseases, Sewers, Urbanization, History.

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Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

The history of water quality management in New York State for the past 100 years can be divided into seven periods: (1) Rural Laissez-faire, 1880-1902; (2) Public Health, 1903-1935; (3) Recognition - Transition, 1935-1949; (4) New Approaches, 1949-1962; (5) Demand for Change, 1962-1972; (6) Preservation and Conservation, 1972-1977; and (7) Balancing Interests, 1977-1982. The first three periods are discussed in detail. The Rural Laissez-faire period was characterized by great social and industrial change. Waterborne diseases such as typhoid, gastro-intestinal disease, and cholera were common and epidemic. The New York State board of health was established in 1880 followed by the State Department of Health in 1901. The basic policy that evolved was the prevention of diseases by water supply protection. The second period, Public Health, was characterized by a rapidly expanding economy during World War I and the 1920s and ended with the great depression. For New York, it was a major sewer building period. Much progress was made toward the elimination of waterborne diseases due to filtration and disinfection of water supplies. Polluted water sources were abandoned which represent a general policy of water resource abuse. The third period, Recognition-Transition, was a time of increasing concern about water quality management and the abandonment policies of the previous years. Many legislative proposals were made and interstate water pollution control agencies were created. The major concern was primary treatment for raw sewage while industrial wastes were virtually ignored. (Seigler-IPA)
W79-10155

ALASKA MINING AND WATER QUALITY, PROCEEDINGS, SYMPOSIUM HELD AT UNIVERSITY OF ALASKA, FARIBANKS, ARPIL 9, 1976.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 797, Price codes: A05 in paper copy, A01 in microfiche. Alaska University, Fairbanks, Institute of Water Resources. Report No. IWR 93, 87 p, April 1979. OWRT A-055-ALAS (1).

Descriptors: *Alaska, *Placer mining, *Water quality, Environmental effects, Water pollution control, Benthos, Gold, Industrial water, Economic impact, Mine water, Permafrost.

Differing viewpoints on controversial issues in Alaskan water resources and mining are presented in 12 papers. The issues covered fall into the major categories of government, industry, and research. Mining and water quality viewpoints are presented from the perspectives of the Federal Government and from the Alaska departments of Environmental Conservation, Fish and Game, and Natural Resources. Aspects of placer mining covered include water quality problems, the Northern Inland Waters Act, environmental controls, water uses, and cost/benefit considerations. Mining industries at Livengood and Nome are discussed. Research is reported in the area of environmental impact, pollution control, and stream water quality following placer mining. (Seigler-IPA)
W79-10157

THERMAL REGIMES OF THE MISSISSIPPI AND MISSOURI RIVERS DOWNSTREAM FROM THE SOUTHERN IOWA BORDER,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
A. R. Giaquinta, and T. T. C. Keng.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 470, Price codes: A10 in paper copy, A01 in microfiche. IIHR Report No. 211, Iowa State Water Resources Research Institute Completion Report No. ISWRR1-92, January 1978. 198 p, 23 fig, 91 tab, 23 ref, 4 append. OWRT B-056-IA (1).

Descriptors: *Missouri River, *Mississippi River, *Mathematical models, *Water temperature, Thermal pollution, Water cooling, Powerplants, Thermal capacity, Heat budget, Hydroelectric plants, Nuclear powerplants, Water pollution sources, Environmental effects.

The steady-state version of the Iowa Thermal Regime Model was used to simulate existing thermal regimes and future thermal regimes resulting from powerplant installations on portions of the Mississippi and Missouri Rivers. The numerical model is presented along with a review of the basic equations used for energy conservation and heat transfer. Temperature distributions are given for existing powerplants and for future powerplants due for installation through 1995. Locations and capacities for future plants were determined within the bounds of existing thermal standards. Calculations were made for average meteorological and hydrological conditions for February, May, August, and November and for the extreme 7-day, 10-year low flow for August and November. Mississippi River results show that existing and future proposed powerplants would not exceed present thermal standards. Future acceptable plant capacity totals are 71,500 MW to 111,800 MW for open-cycle cooling fossil-fueled plants and 49,400 MW to 77,300 MG for nuclear plants. In the Kansas City area of the Missouri River, the river has no remaining additional heat assimilation capacity. Any new open-cycle cooling powerplant upstream from Kansas City would exceed heat standards downstream. Future capacities for other plants are 5980 MW to 12,400 MW for fossil-fueled plants and 4140 MW to 8570 MW for nuclear plants. (Seigler-IPA)
W79-10159

PHYSIOLOGICAL DYSFUNCTION OF THE HAEMOPOIETIC SYSTEM IN A FRESH WATER TELEOST, LABEO ROHITA, FOLLOWING CHRONIC CHLORDANE EXPOSURE, PART I - ALTERATIONS IN CERTAIN HAEMATOLOGICAL PARAMETERS,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
S. K. Bansal, S. R. Verma, A. K. Gupta, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 666-673, 1979. 2 tab, 19 ref.

Descriptors: *Pesticide toxicity, *Fish physiology, Teleosts, Freshwater fish, Chlorinated hydrocarbon pesticides, Chemical analysis, Animal metabolism, Mode of action, Lethal limit, *Chlordane, *Hematology, *Tissue analysis.

In order to evaluate the sensitivity of the haemopoietic system to pesticides, Labeo rohita were exposed to 17, 23, 35 and 70 microgr/l chlordane for 30 or 60 days. A significant decrease in clotting time was observed at 35 and 70 microgr/L. An increase in hemoglobin was observed at all concentrations. Red blood cell counts increased all concentrations while white blood cell counts showed no significant changes. Hematocrit and erythrocyte sedimentation rates also exhibited no significant changes. If the toxicity index of chlordane is determined using these haematological data, the 'no effect' concentration is 17 microgro/L, or 1/12 of the TL50. (See also W79-10187) (Deal-EIS)
W79-10186

PHYSIOLOGICAL DYSFUNCTION OF THE HAEMOPOIETIC SYSTEM IN A FRESH WATER TELEOST, LABEO ROHITA, FOLLOWING CHRONIC CHLORDANE EXPOSURE, PART II-ALTERATIONS IN CERTAIN ORGANIC COMPONENTS AND SERUM ELECTROLYTES,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A
W79-10187

EFFECTS OF TEMPERATURE ON DOMINANT MACROZOOBENTHOS SPECIES OF THE RIVER SAVA UNDER LABORATORY CONDITIONS,
Zagreb Univ. (Yugoslavia). Faculty of Natural Sciences and Mathematics.
For primary bibliographic entry see Field 5A.
W79-10188

INCREASED GROWTH IN MINNOWS EXPOSED TO PCBS,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
B.-E. Bengtsson.
Ambio, Vol. 8, No. 4, p 169-170, 1979. 2 fig, 13 ref.

Descriptors: *Polychlorinated biphenyls, *Toxicity, *Minnows, *Growth rates, Fish diets, Fish physiology, Weight, Animal metabolism, Path of pollutants, Chemical analysis, Gas chromatography, *Tissue analysis, *Bioaccumulation.

Minnows, Phoxinus phoxinus (L), were fed for 29 days with food containing four different concentrations of polychlorinated biphenyls (Clophen A50). The fish were weighed individually at the start and at the end of the experiment. All four groups of minnows exposed to increased levels of polychlorinated biphenyls had gained more in weight than the control group. It is suggested that this phenomenon results from a disturbance of the hormonal system and that the occurrence of stimulated growth is related to seasonal variations in the metabolic activity of the fish. (Deal-EIS)
W79-10190

ANALYSIS OF THE EFFECTS ON ALGAE AND THE MACROPHYTOBENTHONIC COMMUNITY OF THE UPPER PART OF THE INFRALITTORAL ZONE OF MARINE WASTE DISPOSAL VIA THE GRAND SEWER OF MARSEILLE, (IN FRENCH)
Station Biologique de Roscoff (France).
T. Belsher.
Tethys, Vol. 9, No. 1, p 1-16, 1979. 15 fig, 3 tab, 34 ref.

Descriptors: *Phytoplankton, *Biological communities, Sewage effluents, Littoral, Bioindicators, Marine algae, Phaeophyta, Rhodophyta, Dominant organisms, Benthos, Chlorophyta, Statistical analysis, *Species diversity, Mediterranean Sea, Marseille, France.

Modern phytosociological methods, similarity analysis, statistical tests, and 'inertia analysis' have been applied to 22 sites distributed along the shore on the mainland and on Riou, Jarre and Pomegues Islands. The methods have shown that there are clear 'discontinuities' in the 'macrophytobenthic' communities of the upper part of the infralittoral zone. Other remarkable results are concerned with the occurrence of a relatively dense seaweed community in the vicinity of the sewage outlet into the sea, the 'impoverishment' and general disequilibrium of algal communities, and the lowering of 'reproduction' in the maximum pollution zone. Some groups of species appear to be pollution indicators, either because they decrease in abundance (Phaeophyceae, Cryptonemiales, Ceramiales, Gigartinales) or else increase in abundance (Protoflorideae or Bangiophycideae). As a rule Rhodophyceae are dominant in the polluted area. (Deal-EIS)
W79-10191

EFFECTS OF ORGANIC WASTE ON PRIMARY AND SECONDARY PRODUCTION IN THE EMS-DOLLARD ESTUARY,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5A.
W79-10192

EFFECTS OF DDT ON BLOOD PLASMA ELECTROLYTES IN THE FLOUNDER, PLATICHTHYS FLESUS L., IN HYPOTONIC BRACKISH WATER,
Goteborg Univ. (Sweden). Dept. of Zoophysiology.
C. Haux, and A. Larsson.
Ambio, Vol. 8, No. 4, p 171-173, 1979. 2 fig, 1 tab, 19 ref.

Descriptors: *DDT, *Pesticide toxicity, *Electrolytes, Chlorinated hydrocarbon pesticides, Proteins, Chlorides, Magnesium, Ions, Fish physiology, Animal metabolism, Calcium, Phosphates, Potassium, Salinity, *Flounder, *Hematology, *Tissue analysis.

DDT, in sublethal dosages (1.5 and 15 mg/kg body weight), was orally administered to flounders kept

in slightly hypotonic brackish water. In order to study the effects of DDT on osmotic and ionic regulation, the osmolality, as well as the concentrations of various inorganic ions and total protein in blood plasma, were measured after three and six weeks. DDT caused significant decreases in chloride and magnesium concentrations, suggesting an impaired ability to maintain ion homeostasis. (Deal-EIS)
W79-10193

MERCURY IN THE AQUATIC ECOSYSTEMS OF THE PROVINCE OF QUEBEC, CANADA (IN FRENCH),
Environmental Protection Service, Montreal (Quebec).
For primary bibliographic entry see Field 5A.
W79-10194

THE EFFECTS OF OIL DISPERSANTS ON MARINE EGGS AND LARVAE,
Tromso Univ. (Norway). Inst. of Biology and Geology.
S. Lonning, and I.-B. Falk-Petersen.
Astarte, Vol. 11, p 135-138, 1978. 3 tab, 8 ref.

Descriptors: *Oil spills, *Toxicity, Oil, Oil pollution, Animal physiology, Fertility, Reproduction, Larval growth stage, Fish eggs, Crustaceans, Polychaetes, Bioassay, *Dispersants, *Sea urchins.

The effects of the oil dispersants Corexit 7664, 9527, 9600, BP 1100 X, 1100 WD, and Finasol OSR2, OSR5, and OSR7 were tested on eggs and larvae from sea urchins and marine fishes, on nauplii, and on some other plankton organisms. A comparison of the different dispersants shows that the concentrates Corexit 9527 and Finasol OSR5 and OSR7 produce most effects in all types of experiments. A comparison of various organisms and stages shows that the fertilization process of sea urchins and the early development of fish are particularly sensitive to oil dispersants. However, effects are obtained in all kinds of experiments, not only with larvae, but also with adult plankton organisms (medusae and copepods). (Deal-EIS)
W79-10195

MERCURY AND SELENIUM CONTENT OF ODONTOCETI, (IN JAPANESE)
Tokai Regional Fisheries Research Lab., Tokyo (Japan).
For primary bibliographic entry see Field 5B.
W79-10196

HEAVY METAL CONCENTRATIONS AND PHYTOPLANKTON PRODUCTION, BIOMASS AND STRUCTURE IN A NORTHERN ESTUARINE AREA OF THE BALTIC SEA,
Salt and Water Ltd., Helsinki (Finland).
For primary bibliographic entry see Field 5A.
W79-10197

RATIO ATP/CHLOROPHYLL AS AN INDEX OF RIVERS' WATER QUALITY,
Istituto di Ricerca Sulle Acque, Rome (Italy).
For primary bibliographic entry see Field 5A.
W79-10198

EFFECTS OF EXPERIMENTAL OIL SPILLS ON CHIRONOMIDAE IN ALASKAN TUNDRA PONDS,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10199

INTRODUCTION OF WASTE HEAT AND EFFECTS ON MICROORGANISMS,
Bundesanstalt fuer Gewasserkunde, Coblenz (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W79-10200

INFLUENCE OF BEDLOAD TRANSPORT ON THE MACROBENTHOS OF RUNNING WATERS,
Bonn Univ. (Germany, F.R.). Inst. fuer Landwirtschaftliche Zoologie und Bienenkunde.
For primary bibliographic entry see Field 5A.
W79-10201

RELATIVE TOLERANCE OF SOME SALMONIDS TO ACID WATERS,
Norsk Inst. for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A.
W79-10202

MUDDY OFF-FLAVOUR IN BREAM (ABRAMIS BRAMA L.) FROM THE PORVOO AREA, GULF OF FINLAND,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W79-10203

THE PRESENT STATE OF FISHING IN LESTIJOKI, A SMALL RIVER IN FINLAND,
Oulu Univ. (Finland).
For primary bibliographic entry see Field 5A.
W79-10205

INFLUENCE OF TEMPERATURE ON FEEDING, GROWTH AND MORTALITY OF PIKEPERCH AND PERCH,
Rijksinstituut voor Visserijonderzoek, IJmuiden (Netherlands).
J. Willemsen.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 2127-2133, 1978. 4 fig, 13 ref.

Descriptors: Freshwater fish, Yellow perch, *Water temperature, *Cooling water, *Thermal powerplants, *Thermal pollution, Growth, Pikeperch, The Netherlands, Lake Ijssel, Fish food, Flevo powerplant, Bioassays, Laboratory tests, Critical thermal maximum, Upper lethal limit, Water pollution sources.

Two important species of fish, the pikeperch and the yellow perch congregate in the discharge area of the Flevo-powerplant (Lake Ijssel) at temperatures up to 30-31 degrees C. The population density of pikeperch is 300 times that of the species in the lake. It was concluded that in a temperate climate, the discharge of cooling water about 7 degrees C above that of the receiving water is not harmful to pikeperch and perch and stimulates the abundance of food. A slight increase in temperature will stimulate fish growth. (Katz-EIS)
W79-10206

EFFECT OF THE GREEN ALGAE SCENEDESMUS OBLIQUUS AND CHLORELLA VULGARIS ON HETEROTROPHIC BACTERIA IN POLLUTED WATERS,
Hebrew Univ., Jerusalem (Israel). Human Environmental Sciences Lab.
For primary bibliographic entry see Field 5A.
W79-10207

USE OF BIOTIC INDICES AS A TOOL FOR WATER QUALITY ANALYSIS IN RIVERS,
Norsk Inst. for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A.
W79-10208

THE DISSOLVING OF SOME PHOSPHORUS MINERAL COMPOUNDS BY MICRO-ORGANISMS IN THE BOTTOM SEDIMENTS OF FERTILIZED LAKES (IN POLISH),
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
For primary bibliographic entry see Field 5A.
W79-10209

STUDIES ON THE TOXICITY OF A FEW PESTICIDES ON COLISA FASCIATUS AND NOTOPTERUS NOTOPTERUS WITH REFERENCE TO HISTOPATHOLOGY AND HISTOCHEMISTRY. PART I: BIOASSAY STUDIES,
D.A.V. Coll. Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10212

ALUMINUM SULFATE (ALUM) FOR PRECIPITATING CLAY TURBIDITY FROM FISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquaculture.
For primary bibliographic entry see Field 5A.
W79-10214

EMBRYOTOXIC AND TERATOGENIC EFFECTS OF CRUDE OIL ON MALLARD EMBRYOS ON DAY ONE OF DEVELOPMENT,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
D. J. Hoffman.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 632-637, 1979. 1 fig, 1 tab, 7 ref.

Descriptors: *Mallard duck, *Oil, *Toxicity, Bird eggs, Embryonic growth stage, Organic compounds, Growth rates, Mortality, Oil pollution, Mode of action, *Crude oil, *Teratogens.

Fertile eggs of mallard ducks (Aras platyrhynchos) were randomly divided into five groups and treated at 24 h of development as follows: untreated controls, 10 micro L of a mixture of 9 aliphatic hydrocarbons and 1, 5, or 10 micro L of South Louisiana crude oil. External applications of crude oil on eggs resulted in a major decline in embryonic survival 3 days after treatment. By day 18 of development the percentage of survivors in the crude oil-treated groups ranged from 1.4 to 57%. Treatment with aliphatic hydrocarbons (paraffin) had no effect on survival. Mean embryonic weights were significantly lower in the crude oil-treated group. Abnormalities included deformed bills, incomplete ossification of the phalanges, reduction in the size of liver lobes, and general stunting with incomplete feather formation. Single instances of reduction in the number of ribs, abnormal cervical vertebrae, and spina bifida occurred. Treatment with aliphatic hydrocarbons did not result in any of these effects. (Deal-EIS)
W79-10216

HEMATOLOGY AS INDEX OF SUBLETHAL TOXICITY OF ZINC IN A FRESHWATER TELEOST,
Gorakhpur Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-10218

ORGANOCHLORINE RESIDUES IN RAPTOR EGGS IN THE CAYUGA LAKE BASIN,
National Wildlife Federation, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-10220

BEHAVIORAL RESPONSES OF SHINER PERCH TO CHLORINATED PRIMARY SEWAGE EFFLUENT,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5A.
W79-10221

TAURINE AND GLYCINE IN THE GILLS OF THE CLAM PROTOTHACA STAMINEA EXPOSED TO CHLORINATED SEAWATER,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5A.
W79-10222

GROWTH CHANGES IN A POPULATION OF WHITEFISH IN LAKE ERIE,
Pennsylvania Fish Commission, Harrisburg.

R. B. Kenyon.
New York Fish and Game Journal, Vol. 25, No. 2, p 129-139, 1978. 2 fig, 3 tab, 18 ref.

Descriptors: *Fish populations, *Growth rates, Lake Erie, Commercial fishing, Size, Length, Weight, Trophic level, Fish physiology, Habitats, Pennsylvania, Dissolved oxygen, *Whitefish.

Experimental data collected from whitefish in the Pennsylvania waters of Lake Erie from 1971 to 1974 were used to describe the population since its drastic decline after the late 1940's. Growth was calculated and compared with that of the whitefish population of the late 1920's when the stocks were considered abundant. Several body-scale functions were tested for best fit, and the functional geometric mean regression permitted the closest fit to empirical data for mean length. Calculated growth curves for both periods were transformed to Walford regression lines, and the indicated lower rate of growth in recent years was deemed significant. A significant increase in weight per unit of length between the two periods was indicated by length-weight regressions (log transformations). Probable explanations for these changes are discussed, focusing primarily on climatology, the trophic state of Lake Erie and the zoogeography and abundance of whitefish. (Deal-EIS)
W79-10223

AN ASSESSMENT OF THE IMPORTANCE OF TEMPERATURE AS A FACTOR CONTROLLING THE GROWTH RATE OF BROWN TROUT IN STREAMS,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5A.
W79-10225

SHRIMPING AS A SOURCE OF SUSPENDED SEDIMENT IN CORPUS CHRISTI BAY (TEXAS),
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, H. H. Carter, and W. M. Wise.
Estuaries, Vol. 2, No. 3, p 201-203, 1979. 3 fig, 1 ref.

Descriptors: *Suspended solids, *Commercial fishing, *Trawling, Shrimp, Commercial shellfish, Bottom sediments, Turbidity, Dredging, Channel improvement, Sediments, Texas, Corpus christi Bay.

A field study showed that the total amount of sediment disturbed in Corpus Christi Bay each year by shrimp trawling is 10-100 times greater than that dredged in an average year for maintenance of shipping channels. The maximum concentrations of suspended sediment measured in the trails of the shrimp boats were comparable to those observed in the turbid plume off the discharge of the dredge operating in the same area. This is not to suggest that the increased levels of suspended sediment resulting from either of these important activities has a deleterious effect on the biota of Corpus Christi Bay. (Deal-EIS)
W79-10226

BIOASSAY OF BALTIMORE HARBOR SEDIMENTS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 5A.
W79-10227

GROWTH RATES OF JUVENILE MAOMAO, ABUDEFDUF ABSOMINALIS, AT CONSTANT AND CYCLIC TEMPERATURES,
Hawaii Inst. of Marine Biology, Honolulu.
For primary bibliographic entry see Field 5A.
W79-10230

STUDIES OF HERBICIDE TOXICITY IN SOME FRESHWATER FISHES AND ECTOPROCTA,
Vikram Univ., Ujjain (India). School of Studies in Zoology.
For primary bibliographic entry see Field 5A.
W79-10231

GASTRIC EVACUATION IN PLAICE, PLEURONECTES PLATESSA L.: EFFECTS OF TEMPERATURE AND MEAL SIZE,
Glasgow Univ. (Scotland). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10234

PHYTOPLANKTON ECOLOGY OF THE STRAIT OF GEORGIA, BRITISH COLUMBIA,
Fisheries and Marine Service, Vancouver (British Columbia). Pacific Environment Inst.
J. G. Stockner, D. D. Cliff, and K. R. S. Shortreed.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 6, p 657-666, June 1979. 8 fig, 2 tab, 41 ref.

Descriptors: *Estuaries, *Surveys, *On-site investigations, *Phytoplankton, *Canada, Water quality, Primary productivity, Straits, Ecology, Sampling, Analytical techniques, Testing procedures, Salinity, Water temperature, Data collections, Biomass, Dissolved oxygen, Nitrogen, Phosphorus, Foreign research, Zooplankton, Algae, *British Columbia, *Strait of Georgia, *Fraser River.

Observations of phytoplankton production, abundance, and distribution were made at 16 stations in the Strait of Georgia from 1975 to 1977. The primary objectives of this study were (1) to describe over two growing seasons the wax and wane of phytoplankton populations, including their production, distribution, and seasonal succession; (2) to assess, where possible, the impact of natural and man-induced stress on phytoplankton; and (3) to compare recent annual and daily primary production rates with earlier published values from the strait and with world oceanic and coastal marine values, so as to place in perspective the production potential of the Strait of Georgia. The discharge of turbid Fraser River water exerts a strong influence on phytoplankton production and distribution in surface waters by rapid light attenuation and horizontal advection. At plume boundaries and back eddies where light conditions improve, very high production occurs (more than 4-5 gC/sq m/d), because of rapidly replenished nutrients supplied by the Fraser River. Advection, turbulence, zooplankton grazing, and summer nitrate depletion collectively impart a heterogeneous distribution pattern to phytoplankton in the surface waters of the Strait of Georgia. Mean annual production varies from lows of 150 gC/sq m in Fraser River plume to highs of over 500 gC/sq m in sheltered boundary waters of inlets. Recent increases in ammonia and nitrate from land drainage and domestic sewage, mainly through the Fraser River, are related to increases in phytoplankton standing stocks in the Strait. (Humphreys-ISWS)
W79-10261

SURFACE TENSION OF A POLLUTED RIVER WATER,
National Inst. for Environmental Studies, Yatabe (Japan).
For primary bibliographic entry see Field 5A.
W79-10269

CHANGES IN THE AMOUNT OF ORGANOCHLORINE PESTICIDES IN MACROINVERTEBRATE COMMUNITIES OF THE VAL PARMA RUNNING WATERS (ITALY),
Parma Univ. (Italy). Lab. di Ecologia.
For primary bibliographic entry see Field 5A.
W79-10270

EFFECTS OF EFFLUENTS FROM A VARIETY OF SEWAGE TREATMENT METHODS ON PRIMARY PRODUCTIVITY, RESPIRATION AND ALGAL COMMUNITIES IN ARTIFICIAL STREAM CHANNELS,
Norsk Inst. for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A.
W79-10271

PHENOMENOLOGY AND MODELLING OF HEAVY METAL DISTRIBUTION IN LAKES,
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland).
For primary bibliographic entry see Field 5A.
W79-10273

PONTOPOREIA DISTRIBUTION ALONG THE KEWEENAW SHORE OF LAKE SUPERIOR AFFECTED BY COPPER TAILINGS),
Michigan Technological Univ., Houghton, MI. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-10274

PHYTOPLANKTON POPULATION DYNAMICS AND PRODUCTIVITY IN A SEWAGE-ENRICHED TIDAL CREEK IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W79-10275

BY-PRODUCTS OF OXIDATIVE BIOCIDES: TOXICITY TO OYSTER LARVAE,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
M. E. Stewart, W. J. Blogoslawski, R. Y. Hsu, and G. R. Helz.
Marine Pollution Bulletin, Vol. 10, p 166-169, 1979. 1 fig, 1 tab, 18 ref.

Descriptors: *Chlorine, Chlorination, Bioassay, Toxicity, Mortality, Laboratory tests, *Oysters, Larvae, Crassostrea virginica, *Ozone, Ozonization, Power plants, Sewage treatment, Disinfection, Bromate, Bromoform, *Chloroform, Oxidation byproducts.

Selected by-products which are produced upon chlorination or ozonization of seawater were examined for their effect on eastern oyster (Crassostrea virginica) larvae. The compounds, bromate, bromoform, and chloroform, were studied at 0.05, 0.1, 1.0, and 10.0 mg/l. Repeated bioassays indicated that even at these low levels, all three substances produced some larval mortality. This preliminary study suggests that oxidation by-products formed during chlorination or ozonization of power plant cooling waters may have adverse effects upon the growth of marine invertebrates, such as C. virginica, during their delicate larval stages. (Katz-EIS)
W79-10276

INHIBITION OF ESTUARINE BACTERIA BY METAL REFINERY EFFLUENT,
Hull Univ. (England). Dept. of Plant Biology.
For primary bibliographic entry see Field 5A.
W79-10277

SEXUAL MATURATION AS A SOURCE OF VARIATION IN THE RELATIONSHIP BETWEEN CADMIUM CONCENTRATION AND BODY WEIGHT OF MYTILUS EDULIS L.,
Institut National de la Recherche Scientifique, Rimouski (Quebec). Lab. Oceanographique.
For primary bibliographic entry see Field 5A.
W79-10278

LIMNOLOGICAL OBSERVATIONS ON A RECENTLY DREDGED POND (GRAVEL-PIT),
Baden-Wuerttemberg Landesanstalt fuer Umweltschutz (Germany, F.R.).
For primary bibliographic entry see Field 5A
W79-10281

SOME ECOLOGICAL LIMITS OF TOLERANCE OF OCHROMONAS SOCIABILIS,
Konstanz Univ. (Germany, F.R.). Dept. of Biology.
For primary bibliographic entry see Field 5A
W79-10283

DEVELOPMENT OF PLANKTONIC ALGAE IN THE RUHR RIVER DEPENDENT ON NUTRIENT SUPPLY, WATERFLOW, IRRADIANCE AND TEMPERATURE,
Ruhr River Association, Essen (Germany, F.R.). Chemical and Biological Lab.
For primary bibliographic entry see Field 5A.
W79-10284

SAPROBIOLOGICAL EVALUATION OF DUTCH DITCHES USING BENTHIC ALGAE ON ARTIFICIAL SUBSTRATES,
Water Board of the Rhine District, Leiden (Netherlands).
For primary bibliographic entry see Field 5A.
W79-10285

VERTEBRAL DYSPLASIA IN YOUNG FISH EXPOSED TO THE HERBICIDE TRIFLURALIN,
Environmental Research Lab., Gulf Breeze, FL.
J. A. Couch, J. T. Winstead, D. J. Hansen, and L. R. Goodman.
Journal of Fish Diseases, Vol. 2, p 35-42, 1979. 8 fig, 20 ref.

Descriptors: *Fish disease, *Water pollution effects, *Herbicides, *Calcium, *Fish pathology, *Growth stages, *Vertebral dysplasia, *Sublethal effects, Minnows, Cyprinodon, Laboratory tests, Environmental effects, Bioassay, Trifluralin, Fish physiology, Pathology, Pre-emergents, Juvenile fish, Histology, Pesticides.

Sheepshead minnows, Cyprinodon variegatus, exposed to 5.5 to 31 microgr/l of the herbicide trifluralin, throughout their first 28 days of life, developed a heretofore undescribed vertebral dysplasia. This dysplasia consisted of semisymmetrical hypertrophy of vertebrae (three to 20 times normal), characterized by foci of osteoblast and fibroblasts actively laying down bone and bone precursors. Effects of the abnormal vertebral development were dorsal vertebral growth into the neural canal, ventral compression of renal ducts, and longitudinal fusion of vertebrae. Fish, exposed for 51 days to 16.6 microgr/l trifluralin and thereafter depurated for 41 days, showed no increase in vertebral dysplasia during depuration; however, residual spinal column damage was evident. Serum calcium concentrations were elevated in adult fish exposed for 4 days to 16.6 microgr/l trifluralin. Fluorosis or mimicry of hypervitaminosis A are considered possible mechanisms for the osseous effect, but are not considered to be the only possible causes. The highly predictable nature of this disorder in experimental exposures strengthens the probability that young fish may serve as experimental models for determining effects of chemicals on early vertebrate ontogeny, particularly in regard to skeletal development. (Katz-EIS)
W79-10286

EFFECT OF DIETARY MIREX AND PCB (AROCLOR 1254) ON THYROID ACTIVITY AND LIPID RESERVES IN RAINBOW TROUT SALMO GAIRDNERI RICHARDSON,
Guelph Univ. (Ontario). Dept. of Zoology.
J. F. Leatherland, and R. A. Sonstegard.
Journal of Fish Diseases, Vol. 2, p 43-48, 1979. 2 tab, 10 ref.

Descriptors: *Polychlorinated biphenyls, *Aroclor, *Fish physiology, *Water pollution effects, *Mirex, *Rainbow trout, *Sublethal effects, Thyroid activity, Fish diets, Histology, Pesticides, Hormones, Metabolism, Laboratory tests, Bioassays, Trout, Salmonids, Salmo gairdneri.

Rainbow trout were fed diets contaminated with either PCB (Aroclor 1254, 500 microgr/gr dry food) or Mirex (500 microgr/gr dry food). There was no apparent effect of PCB on thyroid histology or on serum thyroid hormone levels. Mirex effected significant reductions in serum T4 and T3 levels without apparent change in the histological appearance of the thyroid. Liver weights and total liver lipid content were significantly greater in PCB-fed fish compared with controls as was the carcass lipid content. Mirex had no apparent effect on liver size or liver lipid content but there was a decline in carcass lipid content which persisted 25 days after returning Mirex-fed fish to the control diet. (D. Katz-EIS)
W79-10287

AN ATTEMPTED POLLUTION ABATEMENT IN THE GULF OF LA NAPOULE (CANNES, FRANCE),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 5B.
W79-10288

EFFECTS OF SELFPURIFICATION AND THE BENTHIC ORGANIC LOAD ALONG A STREAM POLLUTED BY A PIGGERY, (IN FRENCH),
Centre Universitaire de Chambery (France).
For primary bibliographic entry see Field 5A.
W79-10290

INDICATOR COMMUNITIES OF OLIGOCHAETES IN SCANDINAVIAN LAKES,
Uppsala Univ. (Sweden). Inst. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10293

EFFECTS OF SOME PETROCHEMICAL PRODUCTS ON THE SURVIVAL OF DICRANOPHORUS FORCIPATUS O.F. MULLER (ROTATORIA) UNDER LABORATORY CONDITIONS,
Zagreb Univ. (Yugoslavia). Dept. of Zoology.
R. Erben.
Verhandlungen Internationale Vereinigung fur Theoretische und Ungewandte Limnologie, Vol. 20, Part 3, p 1986-1991, 1978. 2 tab, 6 ref.

Descriptors: Oil, Oil spills, *Toxicity, Mortality, *Bioassay, Water pollution effects, *Phenol, Acetophenone, Mesityloxide, Styrene, Benzene, *Ethylbenzene, Cumene, Toluene, Acetone, Laboratory test, Phenol degrading bacteria, Protozoa, Petrochemicals.

The effects of phenol, acetophenone, mesityloxide, styrene, a-methyl-styrene, benzene, ethylbenzene, cumene, toluene and acetone on the species Dicranophorus forcipatus in the closed laboratory system, were examined. The concentrations of phenol were: 10, 20, 100, 200, 300 and 400 mg/l, and of the other compounds were 0.02, 0.2 and 2% (v/v). With phenol, the number of heterotrophic and phenol degrading bacteria were observed. Phenol acts directly toxically in acute conditions, while during chronical conditions the toxicity is reduced, due to biodegradation by phenol bacteria. Other petrochemicals prevent aeration and the animals die because of the lack of oxygen. However, the reduced toxicity of the compounds is due to their evaporation. (Katz-EIS)
W79-10294

EFFECTS OF THERMAL DISCHARGE ON LEAF DECOMPOSITION IN A RIVER ECOSYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-10295

EFFECT OF A STEAM ELECTRIC GENERATING STATION ON THE EMERGENCE TIMING OF THE MAYFLY, HEXAGENIA BILINEATA (SAY),
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W79-10296

A SCANNING ELECTRON MICROSCOPIC STUDY OF PERIPHYTON COLONIZATION IN A SMALL STREAM SUBJECTED TO SODIUM CHLORIDE ADDITION,
Brock Univ., St. Catharines (Ontario). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-10297

EFFECTS OF PULP MILL AND MUNICIPAL EFFLUENTS AND HUMUS LOAD ON THE MACRO- AND MEIOZOOBENTHOS OF SOME FINNISH LAKES,
Jyvaskyla Univ. (Finland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5A.
W79-10298

EFFECT OF AGE, WEIGHT, AND SEX ON THE MERCURY CONTENT IN THE MUSCLES AND SELECTED ORGANS OF NORTHERN PIKE (ESOX LUCIUS L.), (IN POLISH),
Instytut Technologii zym Zywnosci Pochodzenia Morskiego, Szczecin (Poland).
For primary bibliographic entry see Field 5A.
W79-10299

PRELIMINARY EXPERIMENTS WITH SEA URCHIN PLUTEUS AND METAMORPHOSIS IN MARINE POLLUTION BIOASSAY,
Doshisha Univ., Kyoto (Japan). Biological Lab.
For primary bibliographic entry see Field 5A.
W79-10300

CONCENTRATIONS OF PCBS, BHCS AND DDTS RESIDUES IN SEAWEEDS OF THE EAST COAST OF SICILY,
Catania Univ. (Italy). Inst. di Chimica e Chimica Industriale.
For primary bibliographic entry see Field 5A.
W79-10301

EFFECT OF A PUMP-STORAGE HYDROELECTRIC SCHEME ON THE STRATIFICATION AND ECOLOGY OF A SCOTTISH LOCH,
Glasgow Univ. (Scotland). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10302

SOME PRELIMINARY DATA ON NUTRIENTS AND CHLOROPHYLL IN ORGANICALLY POLLUTED RIVERS (GRANADA/SOUTH SPAIN),
Granada Univ. (Spain). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10303

EFFECT OF HYDROLOGICAL CHANGES ON AQUATIC COMMUNITIES IN THE LOWER JORDAN RIVER,
Hebrew Univ., Jerusalem (Israel). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W79-10304

SUITABILITY OF ACTIVATED AH-FILTERED WATER TO STUDY DEVELOPMENT OF SALMONID EMBRYOS, (IN POLISH),
Institute of Icthyology, Szcizecin (Poland). Zaklad Anatomii i Embriologii Ryd.
For primary bibliographic entry see Field 5A.
W79-10307

CHANGES IN DDT, DDE AND DDD CONTENTS DURING PRODUCTION OF CANNED HERRING (THE 'GDANSK HERRING'), (IN POLISH),
Instytut Technologii zym Zyrnosci Pochodzenia Morskiego, Szczecin (Poland). Zaklad Higieny Przemyslu Rybengo.
For primary bibliographic entry see Field 5A.
W79-10308

INDICATOR VALUE OF FRESHWATER OSTRACODA,
Prague Dept. of Water Technology and Environmental Engineering (Czechoslovakia).
For primary bibliographic entry see Field 5A.
W79-10309

THE EFFECT OF OSMOTIC STRESS ON THE SURVIVAL AND RESPIRATION OF THE STONEFLY NYMPH, PARAGNETINA MEDIA,
For primary bibliographic entry see Field 5A.
W79-10313

EFFECTS OF GRANULAR 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73) ON BENTHIC MACROINVERTEBRATES IN A LAKE ENVIRONMENT),
National Fishery Research Lab., LaCrosse, WI.
For primary bibliographic entry see Field 5A.
W79-10314

EFFICACY OF ANTIMYCIN FOR CONTROL OF LARVAL SEA LAMPREYS (PETROMYZON MARINUS) IN LENTIC HABITATS,
National Fishery Research Lab., LaCrosse, WI.
For primary bibliographic entry see Field 5A.
W79-10315

THE TOXICITY OF A PRESUMPTIVE STEEL WORKS EFFLUENT FORMULATION,
University of Strathclyde, Glasgow (Scotland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-10319

5D. Waste Treatment Processes

TECHNOLOGICAL RESPONSE TO SPILLS OF HAZARDOUS SUBSTANCES,
National Science Foundation, Washington, DC. Div. of Advanced Environmental Research and Technology.
E. H. Bryan.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 727-739, 1977. 1 fig, 15 ref.

Descriptors: *Pollutants, *Water pollution, *Waste treatment, *Water pollution control, Equipment, Water treatment, Hazards, Accidents, Waste disposal, Chemicals, Carbon filters, Activated carbon, On-site investigations, Water quality control, *Little Menomonee River(WI), Spills, Hazardous substance spills.

The transport of products from producers to consumers by truck, barge, rail, plane, and pipeline poses a constant threat of sudden and unpredictable accidental contamination of water in our drainage basins. The threat to regional environmental quality and particularly the water ecosystem is analogous to that posed by point and nonpoint sources of pollution, differing principally in unpredictability as to the exact time and place of the accident, specific nature of the pollutant, and the uncertainty of its potential effect on the drainage basin. This paper discussed the circumstances that led to the evaluation of a prototype environmental emergency response unit. This was documented in a film conceived by the Citizens for Menomonee River Restoration, Incorporated, funded by the Environmental Protection Agency, and produced by Swanson Productions, Incorporated, titled: 'Once a River.' (See also W79-10107) (Sims-ISWS)
W79-10119

PRETREATMENT UPDATE,
A. Adamczyk.
Clearwaters, New York Water Pollution Control Association, Inc., Vol. 9, No. 2, p 16, June 1979.

Descriptors: *Pre-treatment(Water), *New York, *Toxins, *Industrial wastes, Municipal water, Waste water treatment, Sludge, Water pollution, Governments, Water quality control, Sewage sludge, Water treatment.

On April 12, 1979, the State of New York requested authorization to administer the national pretreatment program from the U.S. Environmental Protection Agency. The program is designed to regulate the industrial discharge of toxic substances into municipal wastewater treatment systems. Program regulation objectives are to: prevent toxic pollutants that interfere with municipal wastewater treatment facility operation, prevent toxic pollutants that may pass through treatment facilities untreated, and prevent toxic pollutants that would effect the disposal of large volumes of municipal sludge. It will be very difficult if not impossible to implement the program within the required timeframe. The program probably will most severely affect 4,000 of the State's industries and 55 of the States' large municipalities. While local, State, and Federal governments will be involved, it is the local and State governments that are responsible for the actual implementation and enforcement of the program regulations. Municipalities and industries must begin pretreatment no later than July 1, 1983. Federal funding of 75% of eligible costs will be through the EPA and New York State will provide 12 1/2% of the costs. (Seigler-IPA)
W79-10156

EFFECT OF THE GREEN ALGAE SCENEDESMUS OBLIQUUS AND CHLORELLA VULGARIS ON HETEROTROPHIC BACTERIA IN POLLUTED WATERS,
Hebrew Univ., Jerusalem (Israel). Human Environmental Sciences Lab.
For primary bibliographic entry see Field 5A.
W79-10207

SETTLING UNIT FOR CIRCULATED COKE QUENCHING WATER,
Firma Carl Still, Recklinghausen (Germany, F.R.). (Assignee).
J. Stratmann, and M. Strobel.
U.S. Patent No. 4,151,082, 5 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1389, April 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial water, *Water pollution treatment, Settling basins, Separation techniques, Equipment, Water reuse, Closed cycle systems, Coke quenching water.

An improved device for treating water which has been used for the quenching of coke includes a settling basin having at least one sidewall which is substantially vertical and which has a drain surface alongside it which slopes downwardly to the sidewall. It includes a conduit for supplying quenching water over the entire width of the basin. A sludge remover in the form of a dredger shovel is carried on a carriage which may be manipulated to remove the sludge from the bottom of the basin and to advantageously hold it so that the water drains from it through openings in the bucket or shovel. It is then deposited on the drain for further draining of the water back to the basin. (Sinha-OEIS)
W79-10219

SYSTEM AND APPARATUS FOR CONTROL AND OPTIMIZATION OF FILTRATION PROCESS,
Enviro Development Co., Inc., Mountain View, CA. (Assignee).
M. M. Zuckerman, and L. C. Hamer.
U.S. Patent No. 4,151,080, 9 p, 2 fig, 14 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1388, April 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Separation techniques, Control systems, Filtration, Dewatering, Filters, Equipment.

A process control apparatus and system for dewatering a solids ladened slurry of water and waste water employs one or more of four primary process control techniques, depending upon the particular process application. The four process control techniques are: (1) monitoring of the instantaneous solids concentration increase in the dewatering unit, (2) measurement of the rate of change of the solids concentration increase with respect to time, (3) controlled pumping to produce a substantially constant flow rate in the effluent from the dewatering unit until the terminal dewatering pressure is reached, and (4) variation on the amount of conditioning agents added to the influent slurry in response to one or more control signals derived from other components of the dewatering system and apparatus. (Sinha-OEIS)
W79-10233

PROCESS FOR ELIMINATION OF MERCURY FROM INDUSTRIAL WASTE WATERS BY MEANS OF EXTRACTION WITH SOLVENTS,
E. D. Nogueira, A. L. R. Abad, M. B. Muntadas, and J. M. R. Vega.
U.S. Patent No. 4,151,077, 6 p, 1 fig, 22 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1387, April 24, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, Mercury, Separation techniques, Solvents, Solvent extractions, Organic compounds, Product recovery.

A process for eliminating mercury from industrial waste waters by means of extraction with solvents is described, which includes its treatment with an oxidant agent to pass the whole of the mercury to its state of valence Hg++, its subsequent treatment by direct contact with a reducer in order to eliminate the excess oxidant which otherwise would degrade the agent of extraction and with an organic solution that contains the agent that extracts the mercury and leaves it free from the latter for its evacuation into the environment, and regeneration of the agent of extraction by means of its treatment with an aqueous solution of chloride ions, the mercury being recovered in the form of an aqueous solution of mercuric chloride, relatively concentrated. (Sinha-OEIS)
W79-10249

WINTER SPRAY IRRIGATION OF SECONDARY MUNICIPAL EFFLUENT,
Michigan Dept. of Public Health, Lansing.
D. E. Leland, D. C. Wiggert, and T. M. Burton.
Journal of the Water Pollution Control Federation, Vol. 51, No. 7, p 1850-1858, July 1979. 6 fig, 6 tab, 10 ref. EPA R005143-01.

Descriptors: *Sewage effluents, *Waste water treatment, *Irrigation, Sprinkler irrigation, Waste water disposal, Municipal wastes, Runoff, Groundwater, Infiltration, Winter, Ice, Frost, Frozen soils, Phosphorus, Nitrogen, On-site investigations, Data processing, Water pollution, Water pollution sources, Water pollution control, Land application, Spray irrigation, Cold weather.

Land application of municipal effluent in cold climates currently requires wastewater storage for up to 6 months annually. In this study, a 3-ha watershed was irrigated with secondary municipal effluent from East Lansing, Michigan, on a year-round basis with the purpose of assessing the feasibility of land irrigation during cold weather. This irrigation resulted in a heavy ice cover that insulated the soil, reduced soil frost, and allowed infiltration of over 70% of the wastewater. Phosphorus retention in the soil was high (77%), but initial runoff concentrations during ice-melt exceeded 1 mg phosphorus per liter. This high phosphorus runoff was only a small percentage of cold weather loading. Significant infiltration of nitrate-nitrogen to the groundwater occurred. Combined lagoon-land irrigation treatment systems seem to have potential for effective cold season operation with substantial reduction in required storage. (Sims-ISWS)
W79-10257

EFFECTS OF EFFLUENTS FROM A VARIETY OF SEWAGE TREATMENT METHODS ON PRIMARY PRODUCTIVITY, RESPIRATION AND ALGAL COMMUNITIES IN ARTIFICIAL STREAM CHANNELS,
Norsk Inst. for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A
W79-10271

PHENOMENOLOGY AND MODELLING OF HEAVY METAL DISTRIBUTION IN LAKES,
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland).
For primary bibliographic entry see Field 5A.
W79-10273

BY-PRODUCTS OF OXIDATIVE BIOCIDES: TOXICITY TO OYSTER LARVAE,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5C.
W79-10276

WASTE WATER TREATING APPARATUS,
Seiisui Kagaku Kogyo Kabushiki Kaisha, Osaka (Japan). (Assignee).
N. Iwai, and T. Okumura.
U.S. Patent No. 4,149,972, 7 p, 6 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 1018, April 17, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Microorganisms, Aerobic conditions, Equipment.

A waste water treating apparatus comprises thin fan-shaped sheets made of an unfoamed synthetic resin and is assembled via spacers. A tubular member made of a synthetic resin is inserted through holes in the fan shaped sheets and holes in the spacers to form an assembly of the sheets. The assembly is radially placed around a rotating shaft and forms a generally circular rotary body. This rotary body is placed within a waste water treating tank, and the apparatus is operated by rotating the rotary body while it is dipped in waste water to a depth corresponding to about half of its height in the diametrical direction. The waste water is treated by the action of aerobic microorganisms that grow adhering to the rotary body. The fan-shaped sheets which constitute the rotary body permit good adhesions of the microorganisms. (Sinha-OEIS)
W79-10318

APPARATUS FOR REMOVING IMPURITIES FROM WASTE WATER,
Bouligny (R. H.), Inc., Charlotte, NC. (Assignee).
S. A. Rojo.
U.S. Patent No. 4,149,953, 10 p, 5 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 1013, April 17, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Water pollution treatment, Separation techniques, Electrolysis, Adsorption, Flocculation, Electrodes, Aluminum and iron electrodes.

A treating chamber operable as an electrolytic cell is provided, in which the electrodes have large surface areas relative to the volume of the electrolyte. The anode is composed of a quantity of aluminum particles and the cathode is composed of a quantity of iron particles placed in close proximity to the aluminum. Waste water containing impurities is introduced into the treating chamber and utilized as the electrolyte. An electric current is applied to the electrodes to dissolve aluminum and iron, and produce floc in the treating chamber. The impurities in the water are adsorbed and retained by the floc. The waste water may be continuously recirculated from the treating chamber to a holding chamber, or may be moved across the aluminum and iron electrodes in a continuous flow-through system at a predetermined flow rate. The floc containing the adsorbed impurities is separated from the water by conventional means. As an alternative, clean water containing normal dissolved solids may be introduced into the treatment chamber and utilized as the electrolyte. An electric current is applied to the aluminum and iron electrodes to produce floc. Floc-laden clean water is conveyed to a chamber containing waste water, and mixed therewith. Floc containing impurities adsorbed from the waste water then is separated from the water by conventional means. (Sinha-OEIS)
W79-10324

FISH TOXICITY WITH SPECIFIC REFERENCE TO THE PULP AND PAPER INDUSTRY,
Domtar Ltd., Montreal (Quebec).
R. J. P. Brouzes.
In: Proceedings, Water Pollution Abatement Technology in the Pulp and Paper Industry, (1975). p 81-124, 1976. 3 fig, 8 tab, 105 ref, 2 append.

Descriptors: *Bioassay, *Toxicity, *Fish, *Pulp and paper mills, *Waste water treatment, Recycling, Ammonia, Dissolved solids.

Fish bioassay methods are reviewed, and the nature of materials within a mill which are deleterious to the environment as defined by bioassay is discussed. Bioassay to determine the median lethal time and the median lethal concentration is described. Factors which affect the survival of fish near pulp and paper mill effluents include ammonia, carbon dioxide, chlorine, dissolved oxygen, dissolved solids, heavy metals, pH, resin acid and fatty acid soaps, slimicides, sulfur compounds, suspended solids, temperature, and other chemicals. Toxicants in the various process streams are characterized. A sulfite mill with recovery would reduce toxicity or toxicity could be reduced by treating selected process streams. (See also W77-07562) (Small-FRC)
W79-10325

PHYSICAL-CHEMICAL TREATMENT,
Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
A. Wong.
In: Proceedings, Water Pollution Abatement Technology in the Pulp and Paper Industry, (1975). p 125-169, 1976. 19 fig, 4 tab, 32 ref.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Waste treatment, *Separation techniques, Adsorption, Ion exchange, Filtration, Coagulation, Flocculation, Color, Toxicity.

Physical-chemical methods for the treatment of pulp mill wastes are outlined. At present, a complete economically viable physical-chemical treatment system is not available. The general principals of adsorption, ion exchange, adsorptive bubble separation, coagulation, flocculation, membrane separation including reverse osmosis, and ultrafiltration, are described. Applications include detoxification using PPRIC carbon treatment, granular carbon adsorption, and foam separation. Decolorization applications are tabulated. (See also W77-07562) (Small-FRC)
W79-10326

PROCESS FOR PURIFICATION OF WASTE WATER PRODUCED BY A KRAFT PROCESS PULP AND PAPER MILL,
Jet Propulsion Lab., Pasadena, CA.
M. F. Humphrey.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-17949, Price codes: A02 in paper copy, A01 in microfiche. Patent Application (NASA), (1976) 13 p.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Recycling, *Lignins, *Filtration, Waste water treatment, Chemical wastes, Activated carbon, Settling basins, Separation technique.

A simple and relatively inexpensive method was developed for purifying kraft process waste water and extracting the lignins. The wastes are dumped into a settling tank and a quaternary ammonium compound and activated carbon are added. The sludge which forms at the bottom of the tank is filtered, and the solid material is transferred to a dissolving tank and dissolved by adding methanol. The slurry which is formed is and the removed solid material is pyrolized to activated carbon which is reused. Lignin is separated from the remaining liquid. Most of the water recovered using the system is recycled. The recovered lignins are useful materials as they can be competitive with petrochemicals as a source of chemical raw materials. (Small-FRC)
W79-10329

DECONTAMINATION OF WATER CONTAINING CHEMICAL WARFARE AGENTS,
Army Mobility Equipment Research and Development Center, Fort Belvoir, VA.
D. C. Lindsten, and R. P. Schmitt.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A012 630, Price codes: A06 in paper copy, A01 in microfiche. Report 2125, 1975. 116 p, 35 fig, 14 tab, 7 ref.

Descriptors: *Chemical warfare, *Chemical wastes, *Chlorination, *Activated carbon, *Coagulation, Filtration, Demineralization, Ion exchange, Reverse osmosis, Protection, Waste water treatment, Water pollution treatment, Pollutant identification, Pollution sources.

Treatment methods for decontaminating waters containing chemical warfare (CW) agents were investigated. The maximum permissible concentrations of CW agents in water are 0.02 mg/liter nerve agents, 2.0 mg/liter blister agents, 2.0 mg/liter arsenicals as arsenic, 20.0 mg/liter blood agents, and 0.004 mg/liter incapacitants. CBR-contaminated water may be purified by a combination of superchlorination in a Lister bag, activated carbon adsorption, coagulation, filtration, mixed-bed demineralization, and post chlorination. While the standard ERDLator unit did not remove CW agents from water, the use of the CW/BW pretreatment set, in combination with the ERDLator unit, decontaminated the water and incorporated superchlorination, activated carbon adsorption, coagulation, filtration, and post-chlorination. Reverse osmsosis and ion exchange processes were capable of removing certain CW agents. Protective clothing and CW detection devices are also reviewed. (Lisk-FRC)
W79-10330

5E. Ultimate Disposal Of Wastes

EVALUATION OF THE GEOLOGIC AND HYDROLOGIC FACTORS RELATED TO THE WASTE-STORAGE POTENTIAL OF MESOZOIC AQUIFERS IN THE SOUTHERN PART OF THE ATLANTIC COASTAL PLAIN, SOUTH CAROLINA AND GEORGIA,
Geological Survey, Raleigh, NC. Water Resources Div., and Geological Survey, Lakewood, CO. Water Resources Div.
P. M. Brown, D. L. Brown, M. S. Reid, and O. B. Lloyd, Jr.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.75. Geological Survey Professional Paper 1088, 1979. 37 p, 1 fig, 11 plates, 8 tab, 52 ref.

Descriptors: *Underground waste disposal, *Liquid wastes, *Deep wells, *Atlantic Coastal Plain, *Subsurface mapping, Mesozoic Era, South Carolina, Georgia, Planning, Waste storage, Injection wells, Evaluation, *Waste-storage potential.

The report describes the subsurface distribution of rocks of Cretaceous to Late Jurassic( ) age in the Atlantic Coastal Plain, South Carolina, and Georgia, and examines their potential for deep-well waste storage into th part of the regional sediment mass which lies below the deepest zones containing usable ground waters. For the study, usable ground water is considered to be that which contains less than 10,000 mg/L dissolved solids. Using a group of geohydrologic parameters derived from or combining 21 categories of basic data, established from study and interpretation of well cuttings and geophysical logs, a series of 32 regional maps and 8 stratigraphic cross sections was constructed. For each of the eight geologic units delineated in the subsurface, the maps illustrate the distribution of waste-storage potential in terms of areal extent, depth below land surface, sand-shale geometry, and the approximate sodium chloride concentration of a unit's nonusable ground water. In areas where the geologic units contain nonusable ground water, the depth below land surface and the thickness of potential waste-storage reservoir and reservoir-seal combinations are variable.

The range in variability appears to be broad enough to meet the need for a wide choice among the geologic requirements that would normally be considered in selecting specific waste-storage sites for detailed examination. (Woodard-USGS)
W79-10184

WATER POLLUTION CONTROL POLICIES ARE GETTING RESULTS,
Organization for Economic Co-operation and Development, Paris (France). Directorate for the Environment.
J-P. Barde, G. M. Brown, and P. F. T. Buchot.
AMBIO, Vol. 8, No. 4, p 152-159, 1979. 8 fig, 3 tab, 7 ref.

Descriptors: *Water pollution control, *Water quality standards, Water quality, Water pollution treatment, Chemical oxygen demand, Biochemical oxygen demand, Suspended solids, Regulation, Legislation, Metals, Pesticide residues, Organic wastes, Waste treatment, Chemical wastes, Industrial wastes.

Economic and regulatory approaches for water quality management are described. Important elements of the effluent charges system in France, the Netherlands, West Germany, Hungary and Czechoslovakia are cited. The water management structure in France, Finland, the United States, Japan, the Netherlands and England and Wales is touched upon. Empirical results for Japan, the United States, the Netherlands, France and Sweden indicate that at least for conventional pollutants (oxidizable substrate and suspended solids), water quality has ceased to deteriorate in the past decade and in some instances it has improved. (Deal-EIS)
W79-10189

WINTER SPRAY IRRIGATION OF SECONDARY MUNICIPAL EFFLUENT,
Michigan Dept. of Public Health, Lansing.
For primary bibliographic entry see Field 5D.
W79-10257

5F. Water Treatment and Quality Alteration

REGENERATION OF ION EXCHANGE RESINS,
Nalco Chemical Co., Oak Brook, IL. (Assignee).
L. E. Horembala.
U.S. Patent No. 4,151,079, 4 p, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1388, April 24, 1979.

Descriptors: *Patents, *Water treatment, *Industrial water, Boiler feed water, Water purification, Ion exchange, Resins, Anion exchange, Cation exchange, Potassium compounds, Regeneration.

Problems encountered with sodium leakage after regeneration of mixed bed and ion exchange units utilized to purify boiler feed waters can be reduced or eliminated by using as the regenerant for the anion exchange resin an aqueous solution of potassium hydroxide. Likewise, in the regeneration of cation condensate polishing units utilized to purify boiler feed waters, sodium leakage can be reduced or eliminated by utilizing a potassium salt as the regenerant. Additionally, potassium salts of various inorganic reducing agents can also be utilized to remove iron from ion exchange systems operated in the above manner. (Sinha-OEIS)
W79-10086

EVALUATION OF THE MICROBIOLOGY STANDARDS FOR DRINKING WATER.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 119, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-570/9-78-00C, 1978, 235 p.

Descriptors: *Coliforms, *Standards, *Chlorination, Water treatment, Regulation, Public health, Microbiology.

Papers were presented at a meeting held April 13-14, 1977 at the Office of Drinking Water, US Environmental Protection Agency, Washington, D. C. on current microbiological issues and problems associated with the coliform Maximum Contaminant Level and the determination of compliance. Technical problems are discussed, and the possibility of a chlorine residual standard is explored. Sixty-four people attended the conference, and twenty-seven papers were given. (See W79-10128 thru W79-10154) (Small-FRC)
W79-10127

EVALUATING THE MICROBIAL QUALITY OF POTABLE WATERS,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
M. J. Allen, and E. E. Geldreich.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C, p 3-11, 1978. 1 fig, 3 tab, 21 ref.

Descriptors: *Potable water, *Coliforms, *Bioindicators, *Chlorination, Public health, Viruses, Filtration, Flocculation, Monitoring.

The coliform group of microorganisms is the most relevant sanitary index for drinking water. Studies have confirmed that when coliforms are used as an indicator, bacterial and viral safety of the water is assured. Present virological methodology is not developed enough to isolate viruses from finished waters. Present water treatment practices are capable of producing pathogen-free water consistently. Flocculation/filtration with chlorination are dependable biological safeguards. The chlorine dosage and contact times routinely used inactivate all bacterial and viral pathogens except for protozoan cysts. Constant surveillance is necessary to eliminate waterborne disease. (See also W79-10127) (Small-FRC)
W79-10128

INTERFERENCES TO COLIFORM DETECTION IN POTABLE WATER SUPPLIES,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
E. E. Geldreich, M. J. Allen, and R. H Taylor.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C, p 13-20, 1978. 4 tab, 23 ref.

Descriptors: *Potable water, *Turbidity, *Microorganisms, *Microflora, Water quality, Distribution, Coliforms, Regulation.

Interferences to coliform detection in potable water supplies including turbidity and microbial flora. Turbidity, which can be caused by, among other things, algal growth, siltation, industrial wastes, can be a transport vehicle for bacterial penetration of treatment barriers. Water must be free on interferences from tubidities that exceed the 1 NTU limit specified in the Interim Primary Drinking Water Regulations in order to detect coliform occurrences at a baseline of one organism per 100 ml. Bacterial densities over 500 organisms per ml should not be tolerated. Alterations in laboratory methodology can circumvent these interferences to some extent. The ultimate solution is in improved treatment practices and attention to minimizing deterioration of water quality during distribution. (See also W79-10127) (Small-FRC)
W79-10129

IMPACT OF THE COLIFORM STANDARD ON THE TRANSMISSION OF DISEASE,
Health Effects Research Lab., Cincinnati, OH.
G. F. Craun.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C, p 21-35, 1978. 1 fig, 12 tab, 7 ref.

Descriptors: *Diseases, *Monitoring, *Coliforms, *Microbiology, Water treatment, Water pollution, Regulation, Public health.

Outbreaks of waterborne diseases continue to occur, and data on the outbreaks should be used to plan and develop surveillance programs. Emphasis should be placed on surveillance of smaller water systems, particularly those serving travellers. Control programs should include the provision of adequate treatment of surface water sources to prevent outbreaks of giardiasis, assessment of groundwater contamination, maintenance of disinfection, and prevention of contamination of distribution systems. Bacteriological surveillance of water distribution systems for coliforms as proposed in the 1975 Interim Standards are adequate, but an alternative monitoring program is recommended. This program would allow the limited microbiological resources to concentrate on research activities including the etiologic agents responsible for outbreaks of gastrointestinal illness of unknown etiology. The emphasis would be on engineering evaluations or sanitary surveys. (See also W79-10127) (Small-FRC)
W79-10130

ALTERNATIVE INDICATORS OF WATER CONTAMINATION AND SOME PHYSIOLOGICAL CHARACTERISTICS OF HETEROTROPHIC BACTERIA IN WATER,
Montana State Univ., Bozeman. Dept. of Microbiology.
G. A. McFeters, J. E. Schillinger, and D. G. Stuart.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 37-48, 1978. 5 fig, 1 tab, 21 ref.

Descriptors: *Coliforms, *Potable water, *Bioindicators, *Regulation, Water treatment, Public health, Kinetics.

The most promising microorganisms and procedures that have been suggested to indicate water contamination of public health significance are listed, and studies dealing with comparative die-off kinetics of some indicator bacteria and pathogens are discussed. It is recommended that coliforms be retained as the primary group of indicator organisms with a slight relaxation of the Maximum Contaminant Level (MCL) but not less than 3/100 ml. A similar test to the standard plate count should be used as an index of other microorganisms that are present in water. If the total plate count or standard plate count exceed the MCL, then a Limulus lysate test should be performed. By enumeration of heterotrophic bacteria and their products, the safety of finished drinking waters can be determined (See also W79-10127) (Small-FRC)
W79-10131

SOME STATISTICAL CONSIDERATIONS IN WATER QUALITY CONTROL,
National Institutes of Health, Bethesda, MD.
L. Muenz.
In: Evaluation of the Microbiology Standards for Drinking Water. Report EPA-570/9-78-00C p 49-55. 1978. 3 fig.

Descriptors: *Statistical models, *Sampling, *Coliforms, *Bioindicators, Public health, Water treatment, Diseases, Analytical methods, Regulation.

Some statistical aspects of water sampling are explored. Analyses are presented based on the membrane filter method and the assumption that coliform indicators are valuable. Three topics are investigated: how many samples per month are necessary for various size towns, how large should each sample be, and are the present sampling rules (based on the interim regulations of December 25, 1976) well defined. A model is presented of bacterial distribution. Also, historical data regarding the level of waterborne disease by community size are considered. (See also W79-10127) (Small-FRC)
W79-10132

CHLORINE RESIDUAL SUBSTITUTION - RATIONALE,
Health Effects Research Lab. Cincinnati, OH.
L. J. McCabe.
In: Evaluation of the Microbiology Standards for Drinking Water Report EPA-570/9-78-00C p 57-63. 1978. 1 fig, 3 tab, 6 ref

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Descriptors: *Chlorination, *Water treatment, *Performance, *Toxicity, Public health, Treatment facilities.

The advantages and disadvantages of the chlorine residual are discussed. The absence of a residual can immediately signal inadequacy of water treatment or the introduction of foreign material, but the adverse effects of chloroform ingestion or the consumption of chlorinated water is known. Studies which demonstrate the usefulness of the chlorine residual are reviewed. Chlorine substitution is usable for smaller water systems, but for larger systems, the chlorine residual should be permitted. (See also W79-10127) (Small-FRC)
W79-10133

PUBLIC HEALTH CONSIDERATIONS OF THE MICROBIOLOGY OF POTABLE WATER,
Maryland Univ., College Park. Dept. of Microbiology.
R. R. Colwell, B. Austin, and L. Wan.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 65-75, 1978. 2 tab, 32 ref.

Descriptors: *Analytical techniques, *Coliforms, *Microbiology, *Potable water, Regulation, Pathogenic bacteria, Pseudomonas, Public health.

The advantages of microbial analysis over the use of the chlorine residual are discussed. The microbiology of potable water is reviewed, and the monitoring of microbial flora at the water source and during water treatment, storage, and distribution is recommended. Present microbial methods should be examined including blood agar and low nutrient media, pretreatment at low temperatures, and use of a wide range of incubation temperatures, and use of a wide range of incubation temperatures (especially 20-25 C) for the enumeration of total viable bacterial populations. Psychrophiles, mesophiles, and thermophiles should be considered because of the variety of conditions and uses of potable water. The presence of Flavobacterium and Pseudomonas are undesirable and methods for their detection and removal need development. (See also W79-10127) (Small-FRC)
W79-10134

SAMPLING COLLECTION AND HANDLING,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
H. D. Nash.
In: Evaluation of the Microbiology Standards for Drinking Water. Report EPA-570/9-78-00C. p 79-83. 1978. 1 tab, 13 ref.

Descriptors: *Sampling, *Potable water, *Aquatic bacteria, *Optimization, Water analysis, Public health, Regulation.

Proper water sample collection and handling, which are essential to obtain reliable results, are reviewed. Factors which influence the growth of bacterial flora during sample transit include quality of the sample bottle, the bacterial population, density of each type comprising the bacterial population, concentrations of organic and inorganic nutrients, fluctuations in temperature during transit, turbidity, clumping, and antagonistic action. The American Public Health Association 1975 Standard Methods are reviewed. Studies are reviewed relating to transit/storage time of samples. Research dealing with only potable water samples is needed to compile definative data. Presently, potable water samples must be processed within 30 hours after collection or data may not be valid. (See also W79-10127) (Small-FRC)
W79-10135

THE EPA METHODS MANUAL AND THE MICROBIOLOGICAL STANDARDS,
Environmental Monitoring and Support Lab., Cincinnati, OH.
R. H. Bordner, and J. A. Winter.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 85-90, 1978. 1 tab, 6 ref.

Descriptors: *Monitoring, *Analytical methods, *Regulation, Microbiology, Water treatment, Potable water.

A preview is presented of the EPA manual Microbiological Methods for Monitoring the Environment, Part 1 Water and Wastes. The manual meets the specific needs and legal requirements of the Agency to standardize methods used in enforcement, compliance monitoring, ambient monitoring, and research programs. The microbiological methods included represent the best available in the view of the EPA microbiologists. The manual is loose-leaf style which permits easy updating, and new editions are planned to keep the manual current. It is written in a simple, direct style and provides step-by-step instructions. (See also W79-10127) (Small-FRC)
W79-10136

EVALUATION OF STANDARD PROCEDURES: STANDARD METHODS,
California State Dept. of Health, Berkeley.
A. E. Greenberg.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 91-93, 1978.

Descriptors: *Analytical techniques, *Aquatic bacteria, *Coliforms, *Pathogenic bacteria, Publications, Water quality, Streptococcus, Regulation.

An evaluation is presented of the manual called Standard Methods for the Examination of Water and Wastewater. The current edition contains 131 pages on the bacteriological examination of water and waste water. Emphasis is on fecal organisms such as coliforms or streptococci determined by multiple tube dilution or membranes filtration. Small sections are devoted specifically to the detection of certain pathogens. Tentative procedures are included for viruses in water, Staphylococcus and Pseudomonas aeruginosa in swimming pools, yeasts, fungi, actinomycets, and nematodes. A section is included on the determination of iron and sulfur bacteria. It is recommended that the book be adopted as the sole methods source with unacceptable methods excluded by page or section citations in EPA regulations. (See also W79-10127) (Small-FRC)
W79-10137

VIRUS DETECTION,
Wisconsin Univ.-Madison. Food Research Inst.
D. O. Cliver.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C, p95-99, 1978. 1 fig, 14 ref.

Descriptors: *Viruses, *Potable water, *Analytical techniques, *Bioindicators, Water treatment, Turbidity, Aquatic bacteria, Microorganisms.

Virus detection, as it relates to evaluation of the microbiological standards for drinking water, is discussed. A tentative standard method for detecting viruses in drinking water exists, and the method has recovered experimentally-innoculated viruses efficiently from large-volume samples of water. No viruses have been detected in community water supplies using this method. Indicators of viruses could include fecal contaminants, turbidity, coliphages, and vaccine strains of human poliovirus. Presently, it is impossible to demonstrate that a community's water is virus-free. Protection from virus disease probably lies in detecting lapses in treatment practices or distribution. (See also W79-10127) (Small-FRC)
W79-10138

DISINFECTANT RESISTANT ORGANISMS,
Carborundum Co., Niagara Falls, NY.
P. T. B. Shaffer.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 101-102, 1978. 1 tab, 4 ref.

Descriptors: *Chlorination, *Viruses, *Variability, *Standards, Regulation, Potable water, Public health, Laboratory techniques.

Variations in resistance to chlorine inactivation among various strains of virus or among individual numbers of a specific virus strain, are discussed. The assumption that all viruses will exhibit the same die-off rates as laboratory strains is not technically sound. Two isolates recovered from well-treated finished water were subjected to chlorine inactivation, and their inactivation rates were compared with LSc and Mahoney poliovirus strains. The isolates showed chlorine inactivation rates orders of magnitude lower than that of either of the two standard controls. Thus, replacement of a direct standard with an indirect standard of turbidity or chlorine residual would not be sound based on these experiments. (See also W79-10127) (Small-FRC)
W79-10139

THE RELATIONSHIP OF TUBIDITY TO DISINFECTION OF POTABLE WATER,
National Environmental REsearch Center, Cincinnati, OH. Water Supply Research Lab.
J. C. Hoff.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C, p 103-117, 1978.

Descriptors: *Water treatment, *Turbidity, *Disinfection, *Potable water, Suspended solids, Carbon, Nitrogen, Coliforms.

The significance of turbidity as it relates to disinfection efficiency during water treatment is discussed, and possible problems encountered when using turbidity as a contaminant limit, are also discussed. Turbidity is not the ideal indicator of the disinfectability of potable water as this type of turbidity is more important than the amount. Biological data indicate similar disinfection curves at turbidities of 5 and 1. Parameters that should possibly be considered in addition to turbidity include total organic carbon or nitrogen in the suspended solid. Further consideration of the relevance of coliforms as indicators of viral safety is recommended. (See also W79-10127) (Small-FRC)
W79-10140

WASTEWATER REUSE AND THE PROBLEMS OF WATER-BORNE DISEASE,
Texas A and M Univ., College Station. Environmental Engineering Div.
H. W. Wolf.
In: Evaluation of the Microbiology Standards for Drinking Water. Report EPA-570/9-78-00C. p 119-123, 1978. 12 ref.

Descriptors: *Disinfection, *Recycling, *Pathogenic bacteria, *Standards, Coliforms, Viruses, Turbidity, Water quality.

The disinfection of waste water to be reused must destroy bacteria, fungi and yeasts, rickettsia, viruses, protozoans, and helminths and flukes. For disinfection to be successful, drug-resistant bacteria should be determined by periodic surveys and existing coliform standards should be strickly enforced. Special attention should be paid to factors such as turbidity which interfere with the control of viruses. Also, coliphage determinations are useful, as it the disinfection process is working properly, there should be no viable coliphage in the finished water. Basic studies of water quality and organism growth in distribution systems, combined with monitoring efforts can be used to control pseudomonads. (See also W79-10127) (Small-FRC)
W79-10141

EVALUATION OF MICROBIOLOGICAL STANDARDS FOR DRINKING WATER, ENGINEERING CONTROL PRACTICES,
Black and Veatch, Kansas City, MO.
P. D. Haney.
In: Evaluation of the Microbiology Standards for Drinking Water. Report EPA-570/9-78-00C. p 125-141, 1978. 3 fig, 1 tab, 9 ref.

Descriptors: *Potable water, *Sanitary engineering, *Standards, Water quality, Viruses, Chlorination, Design, Management, Monitoring, Turbidity.

Engineering control practices required by potable water standards on microbiological water quality are discussed. Past Public Health Service and present EPA standards are summarized. Problems which small utilities may face in implementing standards are discussed, and common problems with water distribution systems are reviewed. The possibility of required monitoring for viruses and future standards for halogenated compounds are discussed, and their impacts on engineering practices are considered. The current standards are proven and can be met by sound design and good management practices, but meeting future turbidity and virus monitoring requirements will cost more. (See also W79-10127) (Small-FRC)
W79-10142

COMPLIANCE WITH DRINKING WATER REGULATIONS,
Environmental Protection Agency, Washington, DC. Office of Drinking Water
C. W. Hendricks.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C p 145-152, 1978. 2 tab, 5 ref

Descriptors: *Regulation, *Analytical techniques, *Coliforms, *Standards, Water quality, Water treatment, Public health, Sampling.

The requirements of the Safe Drinking Water Act and the Interim Primary Drinking Water Regulations are summarized. Maximum microbiological contamination levels determined by the membrane filter technique and the fermentation tube technique are presented, as are microbiological contaminant sampling and analytical requirements. Problems with the Interim Primary Regulations are discussed. The Maximum Contaminant Levels (MCL) for membrane filter analytical methods do not resolve the question of low many coliform bacteria are assumed present in a single, highly contaminated sample. Also, a method must he developed for dealing with spurious positive results. Finally, the relationship between monthly averages of coliforms and monthly percentages of positive samples needs investigation. (See also W79-10127) (Small-FRC)
W79-10143

IMPLEMENTATION OF THE COLIFORM STANDARD BY A COMMUNITY WATER UTILITY,
Indianapolis Water Co., IN.
R. J. Becker.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C p 169-180, 1978. 2 fig, 8 tab.

Descriptors: *Treatment facilities, *Standards, *Coliforms, *Sampling, Public health, Legislation, Water treatment, Potable water.

The implementation of the coliform standard by the Indianapolis Water Company is discussed. Treatment facilities, seasonal treatment operations, and sampling procedures are outlined. The bacteriological results of the treatment plant effluent and distribution system samples over a 50 year period are presented. Problems that this water company finds with the requirements of the Safe Drinking Water Act include: the requirement that the public be notified of a hazard based on an erroneous test result, and the fact that utilities are responsible for providing safe water at the tap when they have no control over residential plumbing. (See also W79-10127) (Small-FRC)
W79-10146

COMPLIANCE WITH PL 93-523 COLIFORM STANDARDS,
California State Dept. of Public Health, Berkeley
H. J. Ongerth.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 181-188, 1978

Descriptors: *Coliforms, *Standards, *California, *Treatment facilities, *Regulation, Water treatment, Potable water, Public health.

The development of certain aspects of the coliform standards are reviewed, and California's compliance program is discussed. First, the report of the advisory committee which recommended the 1925 Treasury Department standards for drinking water is discussed. Second, the monitoring-compliance program in California is described, beginning with the creation of the Bureau of Sanitary Engineering in 1915. The first state-wide comprehensive sanitary engineering survey of community systems was made in 1930. In the early sixties a program was initiated to require compliance with frequency sampling standards, requirements which were often being ignored by smaller systems. In 1968, about 30% of the water systems failed to meet the coliform standard for one or more months. Reasons for failure to meet standards by some systems in 1976 are discussed. The current standards are stringent but attainable. (See also W79-10127) (Small-FRC)
W79-10147

CANADIAN DRINKING WATER STANDARDS,
British Columbia Dept. of Health, Vancouver
T. P. Subrahmanyan, D. A. Schiemann, A. J. Rhodes, J. Henderson, and E. Bowmer
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C p 189-194, 1978

Descriptors: *Canada, *Standards, *Regulation, Potable water, Public health, Legislation.

The development of Canadian Drinking Water Standards is reviewed beginning with a standard of bacteriological quality passed in 1923 to the 1968 Canadian Drinking Water Standards. Recent recommendations for standards are summarized and compared with similar U.S. standards. The revision process in the U.S. is currently more advanced than in Canada. Also, Canadian standards only provide guidelines for regulatory agencies, although this will change if the new recommendations are adopted. (See also W79-10127) (Small-FRC)
W79-10148

ALTERNATIVE MEANS OF DETERMINING COMPLIANCE,
Colorado State Univ., Fort Collins. Dept. of Microbiology
S. M. Morrison
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C p 197-198, 1978

Descriptors: *Standards, *Enforcement, *Coliforms, *Sampling, Potable water, Water treatment, Statistical analysis

Effective, economical methods for determining compliance which can he applied to small public water systems are now in demand. Several alternatives are briefly presented and discussed. First, volume treated or volume delivered for domestic use could he used to determine required number of tests. Second, a system using a 30, 60, or 90 day running average would better indicate deteriorating water systems. Third, a procedure allowing retesting for three days after a high coliform test would eliminate possible sampling and compliance errors. Fourth, proper statistical design of sampling programs is urged. Also, the concept of public notification is discussed. (See also W79-10127) (Small-FRC)
W79-10149

THE COLIFORM MCL: CAN WE DEFEND IT,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
W. Litshy.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 199-204, 1978. 2 tab, 17 ref

Descriptors: *Coliforms, *Chlorination, *Standards, *Statistical analysis, Potable water, Public health

Aspects of the coliform Maximum Contaminant Level are discussed. The substitution of the chlorine residual for the coliform standard is opposed. The multiple tube technique is proposed as the sole measurement method. Data are presented on sewage effluent which demonstrate that there can be fecal coliforms in water showing a high chlorine residual. Problems with calculation of the Most Probable Number (MPN) for coliforms as outlined in Standard Methods, are outlined. Data demonstrating poor replication of the MPN technique are presented, and the statistics upon which the MPN technique is based are discussed. (See also W79-10127) (Small-FRC)
W79-10150

ALTERNATIVE MEANS OF DETERMINING COMPLIANCE,
Illinois State Dept. of Public Health, Springfield. Div. of Labs.
B. E. Gay.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 205-209, 1978. 5 ref.

Descriptors. *Regulations, *Coliforms, *Sampling, Water treatment, Potable water, Public health.

Problems with determining compliance of water systems with government controls are discussed. Regulations are suggested which would define the qualifications and responsibilities of water sample collectors. Also, similar regulations are urged for small and large community systems, and four samples per month are proposed. Certification of water laboratories is also discussed. The substitution of the chlorine residual for bacteriological testing is opposed. (See also W79-10127) (Small-FRC)
W79-10151

ALTERNATIVE MEANS OF DETERMINING COMPLIANCE,
Illinois Environmental Protection Agency, Springfield. Div. of Public Water Supplies.
Ira Markwood.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 211-214, 1978.

Descriptors. *Standards, *Regulation, *Potable water, *Coliforms, Public health, Water treatment.

Changes in potable water compliance requirements are suggested. First, a running time period for sample collection is proposed rather than the calendar month. Compliance of small systems which are often poor and inadequately operated, is discussed. Because the results of the coliform test can he interpreted in different ways, problems are experienced with the test, especially in small systems. Problems with enforcement are also briefly considered. (See also W79-10127) (Small-FRC)
W79-10152

ALTERNATIVE MEANS OF DETERMINING COMPLIANCE,
Drexel Univ., Philadelphia, PA. Dept. of Biological Science.
W. O. Pipes.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 215-218, 1978. 7 ref.

Descriptors: *Standards, *Coliforms, *Statistical analysis, Potable water, Water treatment, Public health.

Problems associated with establishing microbiological standards for drinking water are discussed. Regulations written in terms of monthly averages do not make the point that no coliforms should be present in treated water or added during distribution; positive results are not acceptable. The Most Probable Number (MPN) concept is discussed, and it is suggested that the MPN should correctly he called the maximum likelihood estimator of the mean coliform density after the work of R. A. Fisher. Better data is needed in order to develop powerful statistical models. (See also W79-10127) (Small-FRC)
W79-10153

ALTERNATE MEANS OF MEASURING COMPLIANCE WITH BACTERIOLOGIC STANDARDS OF PUBLIC WATER SUPPLIES,
New York State Dept. of Health, Albany. Environmental Health Center.
G. W. Fuhs.
In: Evaluation of the Microbiology Standards for Drinking Water, Report EPA-570/9-78-00C. p 219-227, 1978. 27 fig, 1 ref.

Descriptors: *Standards, *Statistical analysis, *Pathogenic bacteria, *Water treatment, Public health, Regulations, Coliforms.

The relationship between bacteriological standards for water supplies and public health risk is examined in terms of the laws of large and small numbers. In areas with large populations, the probability of ingesting an infectious dose is calculated from the probability of ingesting a certain number of viable infectious particles and the probability of infection from such a particle. When the population is small, the ratio of pathogens to indicator bacteria is subject to wide fluctuations depending on the presence or absence of excretus in the watershed. The relationship between these considerations and the establishment of regulations is discussed. (See also W79-10127) (Small-FRC)
W79-10154

WATER PURIFICATION SYSTEM,
L. W. Malik.
U.S. Patent No. 4,151,085, 8 p, 5 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1390, April 24, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, Water quality control, Filtering, Flow control, Microorganisms, Filters, Equipment.

A water purification system has a pre-filter, a series of germicidal radiation chamber filter units alternating with a series of mechanical filter units and it has a flow measuring device fixed to the output part of the final mechanical filtering unit. The rate of flow through the series of alternating germicidal and mechanical filtering units is measured by the flow measuring device and in turn controlled by an electrically operated valve so as to keep the rate of flow at some predetermined and optimal setting with respect to the efficaciousness of the germicidal filters. (Sinha-OEIS)
W79-10217

WATER TREATMENT FOR SMALL PUBLIC SUPPLIES, REPORT OF OPERATION: CUBA, CARRIZOZO, LA LUZ, SAN YSIDRO, BLUEWATER, MORIARTY, HAGERMAN,
New Mexico State Univ., Las Cruces. Dept. of Chemical Engineering.
H. G. Folster, D. B. Wilson, G. Kramer, S. Hanson, and R. Duran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 051, Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute Report No. 107, July 1979, 91 p, 11 fig, 33 tab, 5 ref, 2 append. OWRT T-0009-C-90016-T(7515)(2), 14-34-0001-7515.

Descriptors: *Reverse osmosis, *Electrodialysis, Water quality standards, Water treatment, Cuba(New Mexico), Carrizizo(New Mexico), La Luz(New Mexico), San Ysidro(New Mexico), Bluewater(New Mexico), Moriarty(New Mexico), Hagerman(New Mexico), San Jon(New Mexico).

The major objective was the demonstration of technology development for desalination being successfully applied to bring domestic water supplies into compliance with the National Drinking Water standards. A mobile unit containing the necessary pretreatment and post-treatment equipment to support reverse osmosis and electrodialysis as primary units was assembled. This equipment is described in WRRI Report No. 095, June 1978. (See W78-11208). During the late fall of 1977 and all of 1978 the mobile demonstration unit was operating in eight New Mexico communities: Cuba (pop. 1200), Carrizozo (pop. 1250), La Luz (pop. 2500), Moriarty (pop. 1750), San Ysidro (pop. 250), Bluewater (pop. 2500), San Jon (pop. 300), and Hagerman (pop. 750). This report details the operating experience and the performance data in the two systems - reverse osmosis and electrodialysis. The appropriate standards of the National Drinking Water Act were met in all communities.
W79-10237

HYDROBIOLOGICAL AND CHEMICAL RESPONSE TO THE ADDITION OF IRON AND ALUMINUM SALTS, STUDIED IN THREE LUND-TYPE BUTYLRUBBER RESERVOIRS,
Koudekerk a/d Rijn (The Netherlands).
For primary bibliographic entry see Field 5A.
W79-10280

5G. Water Quality Control

TECHNOLOGICAL RESPONSE TO SPILLS OF HAZARDOUS SUBSTANCES,
National Science Foundation, Washington, DC. Div. of Advanced Environmental Research and Technology.
For primary bibliographic entry see Field 5D.
W79-10119

OILY-WATER SEPARATOR,
J. Sakaguchi.
U.S. Patent No. 4,151,087, 5 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1391, April 24, 1979.

Descriptors: *Patents, *Oil pollution, *Oily water, *Water quality control, Water pollution treatment, Separation techniques, Filtration, Equipment, Ballast water.

A compact oily-water separator for applications as on board ships where space is restricted, uses a single vessel which can perform the functions to be performed in three different vessels located separately. According to the invention, the single vessel of up-stand type has a partition wall which divides the interior of the single vessel into two chambers. A cylindrical filter device is supported by the partition wall so that the upper portion of the filter device is located in the upper chamber and a lower portion of the device is in the lower chamber. The upper chamber is provided with an oil-water mixture inlet and a first oil outlet, respectively and the lower chamber is provided with a third oil outlet and a water outlet. A second oil outlet is connected to the top of the filter device. (Sinha-OEIS)
W79-10164

FLUID SAMPLE COLLECTION AND DISTRIBUTION SYSTEM,
National Aeronautics and Space Administration, Washington, DC. (Assignee).
For primary bibliographic entry see Field 1A.
W79-10167

WATER PURIFICATION SYSTEM,
For primary bibliographic entry see Field 5F.
W79-10217

PROCESS AND PLANT FOR HYDROMECHANICAL RECOVERY OF A FLUID SPREAD IN A THIN LAYER ON THE SURFACE OF ANOTHER LIQUID,
Seaclean S.A. (Luxembourg). (Assignee).
P. Bolli, and J-J. Asper.
U.S. Patent No. 4,151,081, 14 p, 19 fig, 9 ref. Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1388-1389, April 24, 1979.

Descriptors: *Patents, *Oil spills, *Water pollution treatment, *Water quality control, Oil pollution, Skimming, Equipment, Thin films, Oil recovery.

A hydromechanical skimming process works both mechanically and hydrodynamically and is suitable for treating both large contaminated surfaces such as out at sea or in ports, and relatively small contaminated surfaces such as in purification plants. The process comprises the steps of partitioning off at least one portion of the liquid and superimposed fluid up to a depth exceeding the interface between them, reducing the area of the partitioned portion to increase the thickness of the layer of fluid, and recovering at least the major portion of the thickened layer of fluid. The invention also provides a plant for carrying out the process. (Sinha-OEIS)
W79-10224

REMOVING OIL FROM WATER,
Dow Chemical Co., Midland, MI. (Assignee).
D. W. Calvin.
U.S. Patent No. 4,151,078, 3 p, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1387-1388, April 24, 1979.

Descriptors: *Patents, *Oil pollution, *Water quality control, Separation techniques, Adsorption, Silica, Oil recovery, Hydrophobic silica.

Hydrophobic silica, containing sorbed HF values, is used to remove oil from water by sorption of the oil onto the silica and then separating the oil/silica mixture from the water. Furthermore, the invention pertains to recovering the silica from the oil by aqueous treatment in such a manner that the hydrophobicity of the silica is overcome and the silica becomes hydrophilic, thereby releasing the oil. (Sinha-OEIS)
W79-10240

WINTER SPRAY IRRIGATION OF SECONDARY MUNICIPAL EFFLUENT,
Michigan Dept. of Public Health, Lansing.
For primary bibliographic entry see Field 5D.
W79-10257

HYDROBIOLOGICAL AND CHEMICAL RESPONSE TO THE ADDITION OF IRON AND ALUMINUM SALTS, STUDIED IN THREE LUND-TYPE BUTYLRUBBER RESERVOIRS,
Koudekerk a/d Rijn (The Netherlands).
For primary bibliographic entry see Field 5A.
W79-10280

HORIZONTAL SEPARATOR,
F. N. Harris.
U.S. Patent No. 4,149,973, 4 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 1019, April 17, 1979.

Descriptors: *Patents, *Oil pollution, *Separation techniques, Water pollution treatment, Water quality control, Equipment, Filtration, Gravity separation.

An oil-water mixture is introduced into a horizontal trough which is in a container and has baffles directing flow upwardly toward an opening in the container to a trap on the top of the container. Oil separates from the water as it flows along the baffles and moves by gravity separation up into the trap. In interface sensor in the trap opens an oil outlet from the trap whenever a sufficient quantity of oil accumulates. The water flows down from the upper part of the container through a coalescing filter to a water outlet located in the lower part of the container, being a three-stage separator. (Sinha-OEIS)
W79-10291

PROCESS AND COMPOSITION FOR INHIBITING CORROSION OF METAL PARTS IN WATER SYSTEMS,
AMAX Inc., Greenwich, CT. (Assignee).
D. R. Robitaille, and M. S. Vukasovich.
U.S. Patent No. 4,149,969, 5 p, 1 tab, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 3, p 1017-1018, April 17, 1979.

Descriptors: *Patents, *Water treatment, *Scaling, *Corrosion, Water quality control, Industrial water, Organic compounds, Cooling water, Alkali metals.

A process and a composition is described for inhibiting corrosion of metal parts in water systems such

as in recirculating cooling towers and the like, while additionally suppressing scale formation and inhibiting corrosion of copper and copper-containing alloys. A controlled combination of active constituents in effective amounts are added and dissolved. They are: an alkali molybdate salt, a divalent metal cation selected from the group consisting of ZN++, Mn++ and Ni++; 1-hydroxyethylidene-1, 1-diphosphonic acid and the aqueous soluble alkali salts thereof; and an organic agent selected from the group consisting of 2-mercaptobenzothiazole and the alkali salts thereof; 1,2,3-benzotriazole, and tolytriazole. (Sinha-OEIS)
W79-10323

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

SYSTEMATIC DEVELOPMENT OF METHODOLOGIES IN PLANNING URBAN WATER RESOURCES FOR MEDIUM SIZE COMMUNITIES, PHASE II, FINAL REPORT,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. W. Delleur, J. M. Bell, W. N. Melhorn, W. L. Miller, and H. R. Potter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 833, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 112, August 1979. 112 p, 38 fig, 24 tab, 2 append. OWRT C-6106(5213)(11).

Descriptors: *Urban drainage, *Planning, *Methodology, *City planning, Urban runoff, Storm runoff, Systems analysis, Simulation analysis, Storm drains, Detention reservoirs, Storage, Groundwater availability, ILLUDAS, Public participation, Aesthetic values.

The principal objective was the development of methodologies in comprehensive planning of water resources of medium size communities and in extending the planning to a 25 to 30 year horizon. The approach was that of systems analysis involving interaction between several research disciplines and with community groups. The disciplines represented in the research were sociology, geology, surface and groundwater hydrology, water quality, economics, and land use planning. The project was divided into two phases. The first phase was reported in Purdue University Water Resources Research Center Technical Report No. 74, April 1976 (See W76-11175) which addressed the methodologies of models for estimating population growth, water demand, quantity and quality of surface runoff and availability of groundwater sufficient to supply increasing demand and for determining economic trade-offs between alternate drainage systems. In this second phase some of the models of Phase I were extended or coordinated. A simpler groundwater model was developed and new causal stochastic models of the groundwater levels were tested. Existing models for the planning and design of urban runoff quantity and quality were extended and improved. Probabilistic and statistical analyses of the urban runoff quantity and quality were performed. These model improvements and these analyses made it possible to design alternative urban drainage systems with several degrees of storage detention and pollution treatment. These several systems were then evaluated for their direct and indirect economic and environmental impacts on the community. Also evaluated was the acceptability of community policies on drainage, land use, urban growth and environmental quality by community leaders and by the general public. (Wiersma-Purdue)
W79-10081

PLAN OF STUDY FOR THE NORTHERN GREAT PLAINS REGIONAL AQUIFER-SYSTEM ANALYSIS IN PARTS OF MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
G. A. Dinwiddie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-298 141, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-34, March 1979. 20 p, 2 fig.

Descriptors: *Project planning, *Groundwater resources, *Water supply, *Aquifer management, *Great Plains, Montana, North Dakota, South Dakota, Wyoming, Water resources development, Optimum development plans, Systems analysis.

The Northern Great Plains, an area of about 250,000 square miles in parts of Montana, North Dakota, South Dakota, and Wyoming, is underlain by an accumulation of sediments eroded from the Black Hills and from mountains to the west. Principal aquifers are areally extensive beds of sandstone within these sedimentary rocks, some at great depths. Anticipated future water needs dictate that available ground-water supplies be evaluated for management of this natural resource. The U.S. Geological Survey has started (1978) a 4-year study of the Northern Great Plains aquifer system. The objective of this study is to define availability and quality of ground water and to predict the effects of using this resource. To achieve this objective, the ground-water system will be described in terms of spatial distribution, hydraulics, geology, and geochemistry. Once described, the groundwater system will be simulated by mathematical models that will be used to define responses of the system to various management alternatives and assumed development patterns. This initial report describes the framework for the study. (Woodard-USGS)
W79-10171

CONFLICT MANAGEMENT IN FEDERAL WATER RESOURCE PLANNING,
Colorado Univ., Boulder. Inst. of Behavioral Science.
W. B. Lord, L. Adelman, P. Wehr, C. Brown, and R. Crews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 919, Price codes: A06 in paper copy, A01 in microfiche. Program on Technology, Environment and Manm, Monograph No. 28, 1979. 114 p, 4 fig, 2 tab, 76 ref. OWRT C-7700(7258)(1). 14-34-0001-7258.

Descriptors: *Conflicts, *Project planning, *Political constraints, *Decision making, *Political aspects, Methodology, Social participation, Compromise, Institutional constraints, Formulation, Social aspects, Water policy, Institutions, Evaluation, *Conflict resolution, *Alternatives, Multiobjective planning.

Federal water resource planning has become increasingly conflict-ridden, problematical, and costly. The research reported was aimed at analyzing the nature of that conflict, and at designing and testing a conflict management strategy. Conflict may be due to cognitive differences, to differences over social values, and/or to differences between affected interest groups over the distribution of benefits and costs. Often all three types of conflict will occur. An appropriate conflict management strategy should lead to the identification of conflict elements and assist in problem definition. It should include procedures for reducing cognitive differences, encouraging value convergence, and facilitating bargaining between contending interests. A conflict management intervention employing this strategy failed, however, because the institutional setting of Federal water resource planning was incompatible with its application. The dominant political mode within which such planning occurs encourages early commitment to narrowly conceived alternatives and too often forecloses consideration of broader or rival values and of the wider range of alternatives around which bargaining could occur. However, the trust of emerging procedures and guidelines for Federal water resource planning is rational-analytic and thus compatible with the conflict management strategy suggested herein.
W79-10236

6B. Evaluation Process

CONFLICT MANAGEMENT IN FEDERAL WATER RESOURCE PLANNING,
Colorado Univ., Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6A.
W79-10236

6E. Water Law and Institutions

EXPERIENCES WITH THE COLIFORM STANDARD UNDER THE INTERSTATE CARRIER PROGRAM,
Environmental Protection Agency, Boston, MA. Water Supply Branch.
For primary bibliographic entry see Field 7B
W79-10144

INSTITUTIONAL ARRANGEMENTS FOR INTRASTATE GROUNDWATER MANAGEMENT: A COMPARATIVE ASSESSMENT USING VIRGINIA AS A CASE STUDY,
JBF Scientific Corp., Arlington, VA.
For primary bibliographic entry see Field 4B
W79-10235

CONFLICT MANAGEMENT IN FEDERAL WATER RESOURCE PLANNING,
Colorado Univ., Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6A.
W79-10236

GROUND WATER RESOURCES OF GEORGIA,
Georgia Univ., Athens. Inst. of Government.
For primary bibliographic entry see Field 2F.
W79-10241

6F. Nonstructural Alternatives

INSTITUTIONAL ARRANGEMENTS FOR INTRASTATE GROUNDWATER MANAGEMENT: A COMPARATIVE ASSESSMENT USING VIRGINIA AS A CASE STUDY,
JBF Scientific Corp., Arlington, VA.
For primary bibliographic entry see Field 4B
W79-10235

6G. Ecologic Impact Of Water Development

ECOREGIONS OF THE UNITED STATES,
Intermountain Forest and Range Experiment Station, Ogden, UT.
For primary bibliographic entry see Field 7C.
W79-10242

7. RESOURCES DATA

7A. Network Design

AN OVERVIEW OF THE U.S. GEOLOGICAL SURVEY'S QUALITY-ASSURANCE PROGRAM FOR WATER QUALITY,
Geological Survey, Denver, CO. Water Resources Div.
B. A. Malo.
In: Quality Assurance in Air Pollution Measurement, Proceedings of Air Pollution Control Association Specialty Conference, New Orleans, Louisiana, p 70-74, March 11-14, 1979. 3 ref

Descriptors: *Water quality, *Programs, *Analytical techniques, *Water analysis, *Reviews, Data collections, Network design, Sampling, Chemical analysis, Laboratory tests, Training, *U.S. Geological Survey, *Data quality assurance

National hydrologic data needs served by the U.S. Geological Survey, Water Resources Division.

have increased and diversified. The advent of national data storage and retrieval systems with data inputs from varied and different sources necessitates assurance of comparability, precision, and accuracy of data by all data producers. To assure high quality of water-quality data resulting from Water Resources Division activities an extensive program has evolved. This program addresses the areas of field data collection, materials testing, and laboratory analyses. Quality assurance of field activities depends on technicians and professionals trained in data collection and sampling techniques, and on regular review of field activities by experienced, senior personnel. Quality assurance support to the field is provided by a materials testing project that provides standardized materials for evaluation of field instrumentation, supplies, and techniques. The quality assurance program for laboratories covers not only Water Resources Division facilities, but other analytical laboratories that furnish data to the Division. Active programs include laboratory evaluations, preparation and use of reference materials, and independent review of analytical data. (Woodard-USGS)
W79-10163

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY NEW MEXICO DISTRICT, FISCAL YEAR 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
P. L. Soule, and D. W. Wilkins.
Geological Survey open-file report 79-560, March 1979. 84 p, 29 fig.

Descriptors: *Water resources, *New Mexico, *Projects, *Data collections, Surface waters, Groundwater, Network design, Available water, Water quality, Publications, Programs, *US Geological Survey.

This is the first of an annual series of reports in which the program of the New Mexico District, U.S. Geological Survey, Water Resources Division, will be summarized. This report, which is for fiscal year 1978, should be useful to cooperating agencies and to the users of water data in that it summarizes and gives the status of the basic data collection program and all current studies of the Water Resources Division in New Mexico. The water-resource programs of the District are composed of surface water, ground water, and water quality disciplines. As of April 1978 the District had 36 active projects, 30 reports for release, and answered about 5,000 requests for water related information. (Woodard-USGS)
W79-10177

7B. Data Acquisition

SAMPLING METHODOLOGIES FOR ASSESSING RURAL RUNOFF,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W79-10121

PROBABILITY SAMPLING OF SMALL STREAMS: PROBLEMS AND RESULTS,
North Carolina State Univ. at Raleigh. Inst. of Statistics.
D. W. Hayne.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland. Chesapeake Bay Center for Environmental Studies, p 809-830, 1977. 2 fig, 4 tab, 5 ref. EPA R803328.

Descriptors: *Sampling, *Probability, *Statistics, *Model studies. Mathematical models, Statistical models, Flow, Streamflow, Runoff, Drainage, Rivers, Watersheds(Basins), Pollutants, Chemicals, Data collections, Water quality, Nitrogen, Phosphorus, Costs, Planning, Optimization, Hydrology, *Chowan River Basin(VA-NC).

Sampling methods are required in any large-scale study were it is impractical to cover the whole universe under investigation. This status certainly describes any attempt to characterize the small drainages that constitute the main sources of runoff in a river basin. Briefly, the advantages of probability sampling are that it eliminates the inevitable personal bias of judgement sampling, provides a statistical basis for inference and estimation of precision, and is absolutely reproducible as to method (not results) by other investigators. Judgement sampling lacks these characteristics. The objective of this study was to determine the feasibility of applying probability sampling to the study of the total number of small drainage basins that make up a river basin. (See also W79-10107) (Sims-ISWS)
W79-10122

EXPERIENCES WITH THE COLIFORM STANDARD UNDER THE INTERSTATE CARRIER PROGRAM,
Environmental Protection Agency, Boston, MA. Water Supply Branch.
F. Taylor.
In: Evaluation of the Microbiology Standards for Drinking Water. Report EPA-570/9-78-00C. p 153-157, 1978. 7 ref.

Descriptors: *Water sampling, *Analytical techniques, *Water quality control, *Potable water, *Water quality standards, Testing procedures, Monitoring, Coliforms, Interstate, Testing.

The development of the coliform standard under the interstate carrier certification program is reviewed. The original 1914 standard limited the detection of Bacillus coli to one out of five 10 cc portions of any sample. The 1942 and 1946 Public Health Service Drinking Water Standards required number of samples, standard portions, and standard samples. In 1971 the Interstate Carrier Water Supply Program came under the control of EPA. Carrier water quality had to meet all the limits of sections 3.2 and 3.1 of the 1962 standards. These systemized requirements resulted in improvements in reporting, upgrading or monitoring frequency, and improvements in plants and operations. (See also W79-10127) (Small-FRC)
W79-10144

EXPERIENCES WITH THE COLIFORM STANDARD,
Environmental Protection Agency, Chicago, IL.
J. Harrison.
In: Evaluation of the Microbiology Standards for Drinking Water. Report EPA-570/9-78-00C. p 159-168. 1978. 1 tab.

Descriptors: *Coliforms, *Sampling, *Testing procedures, *Bioindicators, *Monitoring, Water quality control, Water quality standards, Testing, Water sampling.

Some typical experiences of public water systems in finding coliform bacteria, and how various state agencies and EPA regions have handled these findings, are reviewed. Case histories illustrating sampling errors, errors in bacteriological sampling techniques, and problems with the Maximum Contaminant Level standard, are presented. Two proposals for further changes in microbiological regulations are presented. These simplify the monitoring process by prohibiting the presence of any coliforms in a certain number of samples rather than by setting acceptable levles of coliforms for samples. (See also W79-10127) (Small-FRC)
W79-10145

THE USE OF A GAMMA LOGGER TO DELINEATE GLACIAL AND BEDROCK STRATIGRAPHY IN SOUTHWESTERN OHIO,
Miami Univ., Oxford, OH. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W79-10246

DECONTAMINATION OF WATER CONTAINING CHEMICAL WARFARE AGENTS,
Army Mobility Equipment Research and Development Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 5D.
W79-10330

7C. Evaluation, Processing and Publication

BASELINE LEVELS AND SEASONAL VARIATIONS OF ENTERIC BACTERIA IN OLIGOTROPHIC STREAMS,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5B.
W79-10111

ALGAL DIVERSITY AND TRANSPORT IN SMALL STREAMS,
North Carolina State Univ. at Raleigh. Inst. of Statistics.
For primary bibliographic entry see Field 5B.
W79-10113

BASIN SIZE, WATER FLOW AND LAND-USE EFFECTS ON FECAL COLIFORM POLLUTION FROM A RURAL WATERSHED,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
For primary bibliographic entry see Field 5B.
W79-10114

SELECTED PATHOGENIC MICROORGANISMS CONTRIBUTED FROM URBAN WATERSHEDS,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
For primary bibliographic entry see Field 5B.
W79-10115

HYDROLOGIC DATA SOURCES,
Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.
J. B. Burford.
In: Watershed Research in Eastern North America, A Workshop to Compare Results, Volume II, February 28-March 3, 1977. Report No. NSF/RA-770255. Smithsonian Institute, Edgewater, Maryland, Chesapeake Bay Center for Environmental Studies, p 909-924, 1977. 2 fig, 11 ref.

Descriptors: *Hydrologic data, *Basic data collections, *Data storage and retrieval, Meteorological data, Rainfall, Precipitation(Atmospheric), Streamflow, Temperature, Land use, Watersheds(Basins), Groundwater, Water quality, Climatic data, Hydrology, Data collections, Computers, Data sources.

Watershed modeling requires hydrologic data as input and for output comparison. The Agricultural Research Service hydrologic data bank, which includes data from several agricultural watershed research studies, is one data source. Other data banks include: Water Data Storage and Retrieval (WATSTORE); National Climatic Center Data Bank; Hydrologic Information Storage and Retrieval System (HISARS); Storage and Retrieval System (STORET); and the National Water Data Exchange (NAWDEX). Data are available from all of these sources at nominal costs. (See also W79-10107) (Sims-ISWS)
W79-10126

FRESHWATER USE IN FLORIDA, 1975,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach.
Florida Bureau of Geology Map Series No. 87, 1978. 1 sheet, 7 fig, 5 ref.

Descriptors: *Florida, *Freshwater, *Water utilization, *Surface waters, *Groundwater, Maps, Water supply, Water demand, Municipal water, Irrigation water, Thermal powerplants, Industrial water, Domestic water, Consumptive use.

Total Florida freshwater uses in 1975 by county from surface- and ground-water sources for public supply, rural, irrigation, industrial, and thermoelectric power generation, are shown on a map. Freshwater use in 1975 was 6,918 Mgal/d compared to 5,768 Mgal/d in 1970. Public water supply demand

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increased from 884 to 1,146 Mgal/d and rural (self-supplied) increased from 195 to 266 Mgal/d, both largely reflecting the increase in population from 6.8 to 8.5 million. Water used for irrigation showed the greatest increase, from 2,099 to 2,868 Mgal/d. Water used for industrial (self-supplied) and thermoelectric power generation remained relatively stable as industrial use increased from 926 to 940 Mgal/d and thermoelectric power generation decreased slightly from 1,700 to 1,698 Mgal/d. The statewide freshwater use is shown from source through use to disposition. For example, of the 1,146 Mgal/d used for public supply, 983 Mgal/d or 85.8 percent was ground water. Disposition of the public supply indicated that 48.9 percent was consumed, with the remaining 51.1 percent (586 Mgal/d) returned to the system for reuse. The major freshwater source for irrigation and thermoelectric power generation is surface water whereas ground water is the major source of water for public, rural, and industrial supplies. (Woodard-USGS)
W79-10173

ECOREGIONS OF THE UNITED STATES,
Intermountain Forest and Range Experiment Station, Ogden, UT.
R. G. Bailey.
1976. 1 fig, 2 tab, 20 ref, 1 map.

Descriptors: *Maps, *Land management, *United States, Ecosystems, Resources, Regions, Regional analysis, Mapping, Geographical regions, Classification, Environment, Ecology, *Ecoregions.

To manage land as heterogeneous as that the Forest Service deals with, we must be able to classify it as to its capability and availability to produce different goods and services. There are a number of different kinds of regions depending upon objective or purpose. Just as a region based on agriculture is an agricultural region, one based on ecosystems is an ecosystem region or ecoregion. To date, most work based on the ecosystem concept of resource management is at a detailed level. There are at least two reasons why a regional view of ecosystem is needed: (1) to permit detailed data to be aggregated into more generalized units for decisionmaking at higher levels; (2) to provide an integrating frame of reference needed to fully interpret the more detailed information. This map was developed to meet these needs. Maps based on classification of climatic types, vegetation associations, and soil groups have been widely used, but no comparable broad-scale synthesis of these maps has been commonly accepted. This map is an attempt to fill that gap. (Froehlich-ISWS)
W79-10242

ESTIMATION OF THE ISOTOPIC COMPOSITION OF LAKE EVAPORATE,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.
G. B. Allison, R. M. Brown, and P. Fritz.
Journal of Hydrology, Vol. 42, No. 1/2, p 109-127, June 1979. 9 fig, 2 tab, 11 ref.

Descriptors: *Isotope studies, *Evaporation, *Evaporation pans, Lakes, Humidity, Estimating, Meteorological data, Temperature, Shores, *Ontario, *Isotopic composition, *Heavy-isotope concentration, *Chalk River, Lake evaporate, Isotope enrichment, Stable humidity, Meteorological conditions, Field conditions.

The use of evaporation pans for determining the isotope composition of water evaporating from a lake has been studied. It was found that useful values of the relevant parameters, the relative rate of isotope enrichment, and the heavy-isotope concentration attained as complete evaporation is approached could be obtained with the size of pan used only when evaporation had proceeded under stable humidity conditions until the pan was almost empty. In practice, meteorological conditions usually changed before this state was reached. One period of meteorologically stable conditions permitted field evaluation of the relative rate of isotope enrichment and the heavy-isotope concentration as complete evaporation approached zero. Comparison with values calculated from free air relative humidities and relative humidities normalized to the evaporating water temperature indicated that the former corresponded more closely to field-measured values. Due to limitations in the field measurements of the above under variable meteorological conditions, these parameters were calculated from the free air relative humidities to deduce day-to-day evaporation values from the isotope concentrations in the pans. (Roberts-ISWS)
W79-10267

8. ENGINEERING WORKS

8A. Structures

COUNTERMEASURES FOR HYDRAULIC PROBLEMS AT BRIDGES, VOLUME 1 - ANALYSIS AND ASSESSMENT,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. C. Brice, and J. C. Blodgett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 132, Price codes: A09 in paper copy, A01 in microfiche. Federal Highway Administration report, FHWA-RD-78-162, September 1978. 169 p, 74 ref.

Descriptors: *Bridges, *Bridge design, *Bridge failure, *Scour, *Erosion control, River training, Geomorphology, Channel morphology, Flow around objects, Flood protection, Bank protection, Bank stability, United States, Canada.

Guidelines have been developed to assist design, maintenance, and construction engineers in selecting measures that can be used to reduce bridge losses attributable to scour and bank erosion. These guidelines are based on case histories of 224 bridge sites in the United States and Canada, on interviews with bridge engineers in 34 States, and on a survey of published work on countermeasures. Each case history (in Vol. 2) includes data on bridge, geomorphic, and flow factors; a chronological account of events; and an evaluation of hydraulic problems and countermeasures. Problems at piers occurred at 100 sites and problems at abutments, at 80 sites. Problems are attributed to local scour at 50 sites, to general scour at 55 sites, and to lateral stream erosion at 105 sites. Performance ratings are given for rigid and flexible revetment, for flow-control measures (spurs, dikes, spur dikes, check dams, jack fields), and for measures incorporated into the bridge. Streams are classified for engineering purposes into five major types, each having characteristics of lateral stability and behavior that need to be considered in the design of bridges and countermeasures. Hydraulic analysis was carried out for flood conditions at 60 bridges, for which values of flow, bridge, and geomorphic factors are tabulated. The report is in two volumes: Volume 1 - Analysis and Assessment; Volume 2 - Case Histories for Sites 1-283. (See also W79-10175) (Woodard-USGS)
W79-10174

COUNTERMEASURES FOR HYDRAULIC PROBLEMS AT BRIDGES, VOLUME 2 - CASE HISTORIES FOR SITES 1-283,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. C. Brice, and J. C. Blodgett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 685, Price codes: A24 in paper copy, A01 in microfiche. Federal Highway Administration report, FHWA-RD-78-163, September 1978. 542 p.

Descriptors: *Bridges, *Bridge design, *Bridge failure, *Scour, *Erosion control, River training, Geomorphology, Channel morphology, Flow around objects, Flood protection, Bank protection, Bank stability, United States, Canada.

Guidelines have been developed to assist design, maintenance, and construction engineers in selecting measures that can be used to reduce bridge losses attributable to scour and bank erosion. These guidelines are based on case histories of 224 bridge sites in the United States and Canada, on interviews with bridge engineers in 34 States, and on a survey of published work on countermeasures. Each case history (in Vol. 2) includes data on bridge, geomorphic, and flow factors; a chronological account of events; and an evaluation of hydraulic problems and countermeasures. Problems at piers occurred at 100 sites and problems at abutments, at 80 sites. Problems are attributed to local scour at 50 sites, to general scour at 55 sites, and to lateral stream erosion at 105 sites. Performance ratings are given for rigid and flexible revetment, for flow-control measures (spurs, dikes, spur dikes, check dams, jack fields), and for measures incorporated into the bridge. Streams are classified for engineering purposes into five major types, each having characteristics of lateral stability and behavior that need to be considered in the design of bridges and countermeasures. Hydraulic analysis was carried out for flood conditions at 60 bridges, for which values of flow, bridge, and geomorphic factors are tabulated. The report is in two volumes: Volume 1 - Analysis and Assessment; Volume 2 - Case Histories for Sites 1-283. (See also W79-10175)
W79-10175

STRUCTURE FOR AUTOMATIC OPENING OF SEDIMENT PLUGS,
Fukunaga and Associates, Honolulu, HI.
J. K. Nishimura, and L. S. Lau.
In Proceedings of the Specialty Conference on Coastal Structures 79/ASCE/Alexandria, Virginia/14-16 March 1979, p 921-940 (1979), 11 fig, 4 plates, 1 tab, 8 ref. Also Contrib. No. 107, Univ. of Hawaii, Water Resources Research Center, Honolulu. OWRT A-070-HI(1), 14-34-0001-7026, 8013.

Descriptors: *Hydraulic structure, Flood control, Froude number, *Channel improvements, Hawaii, Sand plugs, Stream mouths, Oahu.

Closure of stream mouths by littoral sediment is a natural condition of numerous small streams on islands like Oahu, Hawaii. Flood damages induced by floodwater flowing over banks before the blockage is either breached or over-topped can be substantial especially in urbanized areas. Solutions to the problem may be achieved by preventing the formation by using jetties or other similar structures or by removing or breaching the blockage in time before flooding. The first approach is often infeasible for small streams. Mechanical dredging is expensive and effective only if done in time and only for a limited period of time. There are in use hydraulic structures that utilize the hydraulic forces of the early arriving storm flow to breach the blockage. A new design of a hydraulic structure with non-moving parts for automatically opening coastal sediment plugs at small stream mouths has been developed. When positioned properly in the stream mouth, the structure will induce piping and erosion of the sediment plug progressing from the ocean-side toward the stream and resulting in prompt failure of the sediment plug and passage of the flood flow.
W79-10320

8G. Materials

BREAKWATER SYSTEM,
G. E. Hibarger, G. G. Hibarger, and D. W. Daniel.
U.S. Patent No. 4,150,909, 7 p, 9 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1335, April 24, 1979.

Descriptors: *Patents, *Breakwaters, *Floating, Barriers, Shore protection, Structures, Construction materials, Automobile tires.

A floating breakwater is provided consisting of a rectangular array of scrap tires interlocked together in a manner which entirely eliminates the use of tying cables to lash the tires together except for the use of cables in anchoring the floating array in position. A unique tire splice interlocks the tires together so that only tire material is used to construct the floating body, eliminating the need for lashing by cable, ropes which are subject to corrosion and deterioration. (Simha-OEIS)
W79-10260

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

HYDROLOGIC CHARACTERISTICS OF WALKER BRANCH WATERSHED,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W79-10095

THE MAHANTANGO CREEK WATERSHED--GENERAL HYDROLOGY AND RESEARCH RESULTS,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
For primary bibliographic entry see Field 2A.
W79-10097

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ECOREGIONS OF THE UNITED STATES,
Intermountain Forest and Range Experiment Station, Ogden, UT.
For primary bibliographic entry see Field 7C.
W79-10242

DRAINAGE BIBLIOGRAPHY FROM COMPUTER BASED DATA SOURCES,
Science and Education Administration, Orono, ME. North East Plant, Soil and Water Lab.
For primary bibliographic entry see Field 4A.
W79-10253

10F. Preparation Of Reviews

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME I, FEBRUARY 28-MARCH 3, 1977.
For primary bibliographic entry see Field 2A.
W79-10084

WATERSHED RESEARCH IN EASTERN NORTH AMERICA, A WORKSHOP TO COMPARE RESULTS, VOLUME II, FEBRUARY 28-MARCH 3, 1977.
For primary bibliographic entry see Field 2A.
W79-10107

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